3.5 Utilities

This section describes the affected environment, analyzes potential impacts, and provides recommendations for mitigation measures related to utilities, including water, wastewater, surface water, electricity, natural gas, and communications.

3.5.1 Affected Environment

3.5.1 a Water

Service Providers

Two water purveyors offer service in Shoreline: North City Water District and Seattle Public Utilities. Water service in the subarea is split, with Seattle Public Utilities serving the western half, and North City Water District serving the eastern half. A map of the water service area is provided as **Figure 3.5-1.** Note all maps are provided at the end of this section.

Water Supply

North City Water District

North City Water District along with sixteen other water utility districts purchase water wholesale from Seattle Public Utilities. In January 2012, North City Water District completed a new connection with the Seattle Public Utilities NW regional supply, which draws water from both the Tolt and Cedar River Watersheds. The Tolt Watershed acts as the main water supply for the North City Water District, with the Cedar River Watershed as a newly acquired backup water source.

The Tolt River Watershed is located in the foothills of the Cascades in East King County. It supplies about 30 percent of the drinking water for 1.4 million people in the greater Seattle area. The Tolt Reservoir captures water and snow from the Tolt watershed.

The City of Seattle's Cedar River Municipal Watershed is managed to supply drinking water to 1.4 million people in the greater Seattle Area.

The North City Water District contains seven pressure zones. Half of the subarea is located within the 590 pressure zone, the largest zone within the city. In 2013, the North City Water District entered into a new agreement with the Seattle Public Utilities to supply 3,330 gallons per minute (gpm) of water to its customers. In conjunction with the new withdraw rate, The North City Water District conducted an analysis of water currently available to customers within their system. **Table 3.5-1** contains an analysis of their existing and projected water supply demands for the water source feeding pressure zone 590, and all other zones associated with this source.

As indicated in Table 3.5-1, under the North City Water District's current demand projections (estimated growth without the inclusion of the 185th Street Station Subarea Rezoning Option), the District will have a surplus of 882 gpm under peak demands for the year 2030. According to the North City Water District 2011 Comprehensive Plan, the District does not currently forecast to have a deficiency in source capacity through the year 2030.

Table 3.5-1—Water Source Analysis

Year	ERUs[1]	MDD[2] (GPM)	FSS[3] Replenishment Rate (GPM)	Source (GPM)		
				Required	Existing/Proposed	Surplus (Deficit)
2013	7,745	1,836	250	2,086	3,330	1,244
2016	7,977	1,891	250	2,141	3,330	1,189
2030	9,275	2,198	250	2,448	3,330	882

1. ERU = Equivalent Residential Unit is used to convert commercial units and multifamily dwellings to equivalent single family residential units for water demand forecasting purposes
2. MDD = Max Daily Demand
3. FSS = Fire Suppression Storage

Seattle Public Utilities

The Seattle Public Utilities is the primary water purveyor in the area. In addition to the City of Shoreline, SPU services the City of Seattle, and a number of communities and wholesale water purveyors within King County and southern Snohomish County. Seattle Public Utilities current supply estimate is 172 million gallons per day (mgd). Based on Seattle Public Utilities Comprehensive Plan, SPU's source of supply is adequate for demand forecast until 2060.

Water entering the distribution system from the SPU's water sources is treated at a number of treatment facilities. Current water quality readings are adequate for the water system at various water quality sampling locations. In the future, SPU will be evaluating contract extension options for the Tolt and Cedar Water Treatment Facilities.

Water Storage

North City Water District

The North City Water District owns two reservoirs in the area. The reservoirs contain 5.7 million gallons of water collectively. The largest of the storage facilities contains 3.7 million gallons of water storage. This reservoir directly serves the pressure zone in which the subarea is located. The 2011 North City Water District's Comprehensive Plan performed an analysis on this reservoir, and determined it has adequate capacity for the 2030 forecasted demand scenario.

Table 3.5-2 contains a summary of the water storage available to the system in millions of gallons (MG) for Equivalent Residential Units (ERU). An ERU is a unit of measure used to equate non-residential or multi-family residential water usage to a specific number of single-family residences. For example, if a system has sufficient physical capacity to serve 100 ERU's, then that system would have sufficient capability to meet the projected needs of 100 full-time single-family residences. That same system would

also be able to serve any combination of customers (residential, commercial, etc.) provided the quantity of water used is equivalent to the projected needs of 100 single-family homes (100 ERUs).

Table 3.5-2—Water Storage Analysis

Year	ERUs	Grouped Zone Gross Vol. (MG)	Storage Component Volume (MG)					Effective Volume (MG)[5]	Storage Surplus (Deficit) (MG)[6]
			Dead Storage[1]	Standby Storage[2,4]	Fire Suppression Storage[3,4]	Equalizing Storage	Operational Storage		
2016	7977	3.7	0	2.72	1.08	0.16	0	3.7	0.82
2030	9275	3.7	0	3.17	1.08	0.23	0	3.7	0.3

1. Dead Storage includes the stored volume that is not available to all customers at a minimum design pressure. The construction and operation of the North City Pump Station will make use of the dead storage in the 3.7 MG reservoir.
2. Standby Storage determined by Department of Health (DOH) recommendation to provide storage for two days of the system's average day demand (ADD). DOH recommends at a minimum, 200 gallons/ERU.
3. Fire Suppression Storage is a volume available at a minimum pressure of 20 psi to all customers and includes the volume consisting of the highest minimum required fire flow rate and duration.
4. Standby and Fire Suppression Storage are consolidated (nested).
5. Effective Volume is the total volume of the reservoir less any dead storage.
6. Storage Surplus is the Effective Volume, less the larger of the Standby and Fire Suppression Storages, less the Equalizing Storage.

In addition to the reservoirs, the North City Water District contains four source withdrawals and two booster pump stations that work in conjunction to supply water to its customers. The Tolt Booster Station 1 has a capacity of 2,000 gpm with alternating pumps, and Tolt Booster Station 2 has a capacity of 2,300 gpm with alternating pumps.

In 2013, the North City Water District installed a fourth supply station into their network. With the two booster pump stations, the new supply station, and 3.7-million-gallon reservoir, the District projects to have adequate water storage capabilities for the forecasted demand of 2,448 gpm in year 2030.

Seattle Public Utilities

The Seattle Public Utility District owns and operates a number of water storage facilities within the City of Shoreline. The subarea is primarily serviced by the Lake Forest Park open reservoir, which contains 60 million gallons of available water storage. A $31-

million project was completed in 2002 to cover the Bitter Lake and Lake Forest reservoirs, both of which serve areas within the Shoreline city limits. Seattle Public Utilities is currently in the process of replacing a number of existing surface reservoirs with underground structures. In 2020, the floating covers on Bitter Lake and Lake Forest Park Reservoirs will be evaluated for their remaining service life and possible replacement.

Modeling of the water conveyance system has verified that the Lake Forest Park reservoir is currently adequately sized for the population. No upsizing of the reservoir is projected in the near future.

Water Distribution

North City Water District

According to the North City Water District's Comprehensive Plan, over 50 percent of the District's mains were installed between 1966 and 1968. The North City Water District's distribution and transmission main inventory identified approximately 10 percent of their network as 4" mains or less, 54 percent as 6" mains, 35 percent as 8" to 12" mains, and less than 3 percent as larger than 12" mains. In order to ensure adequate fire flow within the system, when a new development is constructed, they are required to upsize all public water mains adjacent to their development to a minimum 8" diameter to provide adequate fire suppression.

In order to ensure adequate fire flow within the system, prior to starting a new development, an applicant is required to apply for a Certificate of Water Availability. Once the application is complete and the fees paid, the District will conduct a Fire Flow Analysis using a computer hydraulic model to determine the amount of flow and pressure available at the property in question. If the result of the analysis indicates there is sufficient fire flow, the Certificate of Water Availability will be issued to the property owner. If the result of the analysis indicates there is insufficient fire flow, improvements will be required.

The majority of water mains within the North City Water District's portion of the subarea are 6" diameter mains. A series of 12" mains run along 12th Avenue NE, from NE Serpentine Place to NE 180th Street, then north along 10th Avenue NE. A 10" diameter main crosses I-5 and runs down 5th Avenue NE, servicing approximately 100 customers on the west side of I-5. No mains within the North City Water District portion of the subarea are less than 6" in diameter.

Seattle Public Utilities

Pipe diameter ranges from 2" distribution mains to 30" transmission mains within the subarea. Within the Seattle Public Utilities region of the subarea, there are 7,200 feet of water mains less than 6" in diameter, 23,800 feet of water mains between 6" and 12", and 10,300 feet of water mains greater than 12". A 30" water transmission main runs along NE 185th Street, between the primary 66" supply main from the Lake Forest Park water reservoir and Aurora Avenue N. The 30" steel transmission main was installed in 1955, and is approaching the end of its serviceable life.

Current Demand for Water

Residential water demand is based on a survey generated by Seattle Public Utilities regarding wholesale water customers. The study includes the North City Water District residential demand per household. A comparison of residential water demand for the North City Water District, Seattle Public Utilities District, and Seattle's Wholesale customers is shown in **Table 3.5-3**

For the purposes of this analysis, the average water consumption of 171 gpd per single family residential household will be used for the residential demand calculations. Commercial water use is based on Equivalent Residential Units (ERUs), with 171 gpd per ERU. For the purposes of this study, 1 ERU is equivalent to 2.4 employees.

Table 3.5-3—Water Consumption Analysis

	2008	2009	2010	2011	2012
North City Water District	169	171	171	140	139
Wholesale Average	179	193	164	165	172
Seattle	140	145	145	128	130

With these demand figures, the North City Water District supplies 358,288 gpd of water during peak season operations to their portion of the subarea, and Seattle Public Utilities supplies 310,892 gpd to their portion of the subarea. The total demand within the subarea under current conditions is estimated to be 669,180 gpd.

Fire Flow

According to Seattle Public Utilities (SPU), all fire hydrants were tested in their section of Shoreline in 2012. The "Modeled ADD Fire Flow in Shoreline August 30, 2012" map depicts the available fire flow in the SPU region of the city. According to the map, the subject area is within the 590 feet of elevation pressure zone. Current fire flow for the area ranges in pressure from 2,000 gpm to over 4,000 gpm. Two fire hydrants within the subarea currently operate between 1,000 and 2,000 gpm. An area south of the subarea on N 175th Street contains nine hydrants operating with a flow between 1,000 gpm and 2,000 gpm.

3.5.1.b Wastewater

Service Provider

The City of Shoreline is served by the Ronald Wastewater District. The Ronald Wastewater District is currently a municipal utility governed by elected officials. A joint merger between the City of Shoreline and the Ronald Wastewater District is currently being evaluated, which would make the wastewater system a City owned and operated utility.

The subarea is located within five sewer drainage basins, and is served by three lift stations owned and operated by the Ronald Wastewater District. The majority of the wastewater flows to the southeast through a series of pipes ranging from 15" to 30" in diameter. A map of the wastewater lines in the subarea is provided as **Figure 3.5-2** at the end of this section.

Wastewater Treatment Facilities

Wastewater collected from the Ronald Wastewater District is treated at two separate treatment facilities, King County's West Point Treatment Plant and the City of Edmonds Treatment Plant.

King County's West Point Treatment Plant treats wastewater from homes and businesses in Seattle, Shoreline, North Lake Washington, North King County, and parts of South Snohomish County. The treatment plant treats 90 million gallons per day (mgd) of sewage during the dry months, and up to 440 mgd during the rainy season. The Ronald Wastewater District currently pays King County based on the number of residential customer equivalents within the District, which are tributary to the West Point Treatment Plant. There is currently no cap on the amount of wastewater the Ronald Wastewater District is allowed to discharge to the West Point Treatment Plant. Currently an estimated 3.82 mgd of wastewater is transported from the Ronald Wastewater District to the West Point Treatment Facility.

The City of Edmonds Wastewater Treatment Plant treats wastewater from the cities of Edmonds, Mountlake Terrace, and Lynnwood; as well as parts of King County; Olympic View Water and Sewer District; and Ronald Wastewater District. On average, the City of Edmonds Wastewater Treatment Plant treats 5.6 mgd of wastewater. The District pays the City of Edmonds based on the actual volume of wastewater discharged to the Edmonds Treatment Plant. Due to monitored flow rates, Ronald Wastewater District pays not only for customer wastewater generation, but also infiltration and inflow (I/I) that leaks into their system from high groundwater tables and unmonitored connections within the system. On average the Ronald Wastewater District discharges 0.33 mgd of wastewater to the Edmonds Treatment Plant and has a treatment capacity daily limit of 0.861 mgd.

Water Reclamation

Reclaimed wastewater is a way to reduce wastewater discharge, as well as reduce potable water demand. Treated wastewater effluent can be distributed back to the communities for non-potable uses, such as industrial water use, landscaping, and flushing toilets. Treated wastewater is never reused for drinking purposes.

Typically reclaimed water is transported through a network of "purple pipes." The cost of building infrastructure to move water from reclaimed water plants to customers is one of the most significant challenges to the distribution and use of reclaimed water. Legislative approval is needed for an expanded grant program to fund reclaimed wastewater treatment and transportation.

King County made reclaimed water available for on-site industrial processes and landscape irrigation at two wastewater treatment plants in 1997. King County's current reclaimed water program produces 284 million gallons of Class A reclaimed water per year at these two regional wastewater plants. A portion of the wastewater produced within the subarea is transported to the West Point Treatment Plant, which has the potential to produce up to 0.70 mgd of Class A reclaimed water from an average capacity of 133 million gallons per day.

Seattle Public Utilities performed a study on the viability and cost analysis of installing a new and much larger reclaimed water distribution system from the Brightwater Treatment Facility, which went online in 2011. The analysis examined the benefits and disadvantages of installing reclaimed "purple pipes" to facilities in North Seattle and Shoreline. The study analyzed potential commercial customers which could benefit from reclaimed water. The study identified 60 potential reclaimed water customers divided into five categories within the North Seattle and Shoreline communities:

Golf Courses	4
Cemeteries	7
Parks	19
Schools	20
Other	7
Total	60

It was estimated that the full life-cycle cost of building and operating a distribution system to deliver reclaimed water from the Brightwater Treatment Facility to potential customers in North Seattle and Shoreline would be about $109 million.

The potential benefits of this reclamation project were found to be minimal. Calculations showed that the project would reduce peak season demand from Seattle's regional water supply system by up to 0.7 mgd. By itself, this amount is too small to have a detectable positive impact on regional water supply, reliability, or environmental conditions in the Cedar River and Tolt River. The project would reduce the peak season withdrawals of self-supplied irrigators from their own local supplies by up to 1-mgd. This might provide small improvements in habitat conditions for several streams in the area, though it would not be expected to result in significant increases in biological productivity. The project would reduce the discharge of pollutants from King County treatment plants into Puget Sound by about 0.04 percent.

Although the analysis determined that a purple pipe distribution system would not be cost effective to serve a large number of relatively small customers, dispersed over a large area, as areas redevelop, this type of system could become more cost effective. Other alternatives are currently being pursued to minimize wastewater discharge and reduce water consumption in the area. Currently, the two existing water reclamation facilities are the only facilities in operation. There could be the potential to introduce future water reclamation facilities within the King County wastewater system. However, this is not currently being actively pursued.

The City of Shoreline should coordinate with service providers to monitor advancements in water reclamation systems regionally on an ongoing basis in the future, and to determine opportunities to use these systems with new development/redevelopment as feasible. The potential to convert existing systems also should be evaluated with advancements in the use of this technology in the region over time.

Wastewater Collection Systems

The subarea contains 80,700 feet of mains between 6" and 12", and 370 feet of mains larger than 12".

The primary sewer basin collects wastewater flowing south, concentrating the flow along NE Serpentine Place to NE 175th

Street. The network of pipes that connects to this discharge point ultimately connects to the King County's West Point Treatment Plant further down the system.

The second main discharge location is to the north along 5th Avenue NE. The network of pipes that connects to this discharge point also ultimately connects to the King County's West Point Treatment Plant.

The Ronald Wastewater District contains primarily gravity sewer mains within the subarea. However, due to topography, a few areas within the subarea are serviced by sewer lift stations. **Table 3.5-4** contains a summary of the sewer lift stations currently servicing a portion of the subarea.

Table 3.5-4—Ronald Wastewater District Lift Stations

Station #	Location	Pump Type	GPM @ Head
8	1208 NE 201st St	Wetwell/Drywell w/ Standby generator	100 gpm @ 39 ft
14	343 NE 178th St	Wetwell/Drywell	240 gpm @ 37 ft
15	18349 10th Ave NE	Wetwell/Drywell w/ Standby generator	550 gpm @ 120 ft

Current Demand

The wastewater demand for the City of Shoreline is based on a study performed by CHS Engineers, LLC for the Ronald Wastewater District's 2010 Comprehensive Plan. Residential wastewater generation is estimated at 85 gpd per person. Commercial wastewater generation is estimated at 187 gpd per Equivalent Residential Unit (ERU) with 2.4 employees per ERU. Based on these generation quantities, the average daily wastewater demand within the subarea under current conditions is estimated at 788,063 gpd.

3.5.1 c Surface Water

Service Provider

The City of Shoreline owns and maintains its own surface water collection system. The City of Shoreline Surface Water Master Plan (adopted in 2005 and updated in 2011) outlines the surface water management program adopted by the City.

Drainage Basin

The City of Shoreline contains seven drainage basins, to which surface water facilities discharge. The subarea drains to two of these drainage basins.

Thornton Creek

The south and western half of the site drains to the Thornton Creek Basin. The Thornton Creek Basin drains approximately 2,418 acres in the southeast quarter of the City of Shoreline. The basin is almost completely developed, with only about 3-percent of the basin remaining as vacant or open space. Land use in the basin is primarily single-family residences and roads. Commercial areas are the next most prevalent land use type, followed by institutional uses. Currently, there is a relatively small amount of

multifamily use or apartments. Since I-5 intersects this basin, it and the resulting connector streets and on/off ramps contribute a large volume of impervious surface runoff to the basin.

The Thornton Creek drainage system contains primarily piped and channeled surface water conveyance within the City of Shoreline. There are very few natural water courses remaining in the upper basin due to development. Many wetlands and hydraulically sensitive areas have been altered or filled in this drainage basin, dating back to the 1950s and 1960s. Very few natural infiltration or surface water storage facilities remain in this basin to assist with peak flow demands.

Over the years, urbanization of the drainage basin without mitigation to address runoff impacts has increased erosion and sedimentation within the creek, due to increased peak flows. This includes activities such as building homes without adequate drainage systems, filling in drainage ways, and construction without sufficient erosion control measures.

The subarea drains into two of the main sub-basins for Thornton Creek. The majority of the subarea portion that discharges to Thornton Creek ultimately discharges to Ronald Bog. The north branch of Thornton Creek's main stem begins near the intersection of 180th Street and Corliss Avenue. This drainage flows through piped water courses into Ronald Bog, a 7.7-acre pond that was previously a peat bog. Outflow from the pond is regulated by a 30-inch diameter pipe extending over 1,000 feet. This pipe is at a reverse grade and contributes to flooding into the area immediately south of Ronald Bog.

The remaining southeastern portion of the subarea, which discharges to Thornton Creek, ultimately discharges to Littles Creek. Littles Creek flows south along the east side of I-5 to Thornton Creek. The tributary originates as a piped system near NE 174th Street and 14th Avenue NE, near the southeastern corner of the subarea. This sub-basin collects drainage from mostly residential areas. A retention pond with a pumped overflow at the southwest corner of 170th Street NE and 15th Avenue NE drains to Littles Creek. A piped water course carries drainage from Paramount Park to the tributary. The tributary then passes through the Paramount Park Open Space, which has a 6.9-acre wetland system and two open water ponds.

McAleer Creek

The north and eastern portions of the subarea drain to McAleer Creek. Within the City of Shoreline, surface water enters McAleer Creek Basin in three ways: through a piped network of tributaries to Echo Lake, which in turn drains into Lake Ballinger; through piped networks discharging directly into Lake Ballinger; and through piped networks discharging to either McAleer Creek or one of its tributaries. The portion of the McAleer Creek Basin within the city totals approximately 1,322-acres. Land use in the McAleer Creek Basin is predominantly residential, although there is a moderately large commercial/industrial section along the Aurora Avenue N corridor. There are small areas of schools, parks, open space, and a cemetery which drain into McAleer Creek. Roads make up the largest impervious area in the basin.

The headwaters of McAleer Creek begin in the Hall's Creek and Echo Lake watersheds, both of which drain into Lake Ballinger. McAleer Creek begins at Lake Ballinger's outlet and flows through the City of Mountlake Terrace, the City of Shoreline, and the City

of Lake Forest Park. The main stem of McAleer Creek enters the City of Shoreline in the area enclosed by the south cloverleaf off-ramp for Interstate 5 at NE 205th Street and exits the city just downstream of NE 196th Street.

McAleer Creek passes beneath NE 205th Street through a 4-by-6-foot box culvert. The creek flows approximately 300 feet in an open water course before entering a culvert beneath the south cloverleaf off-ramp for Interstate 5. Downstream of the south cloverleaf, the stream flows 24 feet before entering a 72-inch diameter culvert beneath Forest Park Drive NE. Downstream of Forest Park Drive NE, the stream flows approximately 1,500 feet to a 4-by-4-foot box culvert beneath 15th Avenue NE. At this point, the west tributary flows into the main stem just upstream of the 15th Avenue NE box culvert. From there, the creek continues its course until it reaches the McAleer Creek Regional Detention Pond on the north side of NE 196th Street and approximately 500 feet east of 15th Avenue NE.

The McAleer Creek Regional Detention pond is controlled with a sluice gate at the upstream end of the dam. The pond's maximum surface area is 1 acre and it extends 550 feet upstream of NE 196th Street in a natural ravine on McAleer Creek.

After exiting the pond, McAleer Creek flows through a 12-by-8-foot box culvert under NE 196th Street, where it leaves the City of Shoreline and enters the City of Lake Forest Park. The channel section in this area transitions gradually from a manmade residential channel to a natural ravine. The main stem of McAleer Creek then flows through Lake Forest Park and empties into Lake Washington.

The subarea drains into four of the main sub-basins for McAleer Creek. The northern section of the subarea drains into the west tributary of McAleer Creek. The west tributary drains the Interstate 5 corridor and west basin south of NE 205th Street. The west tributary follows along the west side of 6th Avenue NE as an open water course. It remains open, running east along NE 200th Street, until it enters a culvert just west of I-5. The tributary remains piped for approximately 1,500 feet and daylights just before its confluence with the main stem. The west tributary drainage enters the main stem in an open channel upstream of 15th Avenue NE.

The eastern section of the subarea drains into two sub-basins. A portion discharges into Brookside Creek. Brookside Creek drains into McAleer Creek just downstream of NE 178th Street in the City of Lake Forest Park. At the Brookside Elementary School in Lake Forest Park, the tributary divides into west (Hillside Creek) and south (Brookside Creek) forks. The Basin Characterization Analysis states that it is not evident in the field whether either fork extends into the City of Shoreline (Tetra Tech/KCM 2004d).

The other portion discharges into Whisper Creek. Whisper Creek (also called Cedar Brook Creek) enters McAleer Creek from the west, out of a ravine approximately 200 feet downstream from Perkins Way near NE 185th Street. Segments of the creek lie inside Shoreline's city limits. The total length of the segments in the city is approximately 1,300 feet. Predominantly spring-fed from five major sources within the Shoreline city limits, the tributary potentially offers, for its size, the best continuous clean water source, cover, and substrate in the basin, and contributes to good water quality in the lower main stem of McAleer Creek.

The western corner of the subarea along N 185th Street, from Stone Avenue N to Aurora Avenue N (Hwy 99) enters the Echo Lake Drainage sub-basin. Echo Lake is in the western portion of the McAleer Creek Basin. Echo Lake has a year-round open water area of approximately 13 acres. The outlet stream from the lake, beginning at the lake's north end, flows north to Lake Ballinger (outside the city), which in turn outlets into McAleer Creek. The outlet of the Echo Lake is piped until passing beneath North 200th Street. North of the street crossing, the drainage is highly confined as it flows through an open water course surrounded by a commercial development to the west and residential neighborhood to the east. The primary inlet to the lake is a pipe entering at the south end that drains an area extending west of Aurora Avenue N.

Surface Water Treatment Facilities

There are a number of treatment facilities and detention facilities within the subarea. Surface water infiltration occurs within a few of the parks within the subarea. The largest infiltration area is in Shoreline Park (owned by the City of Shoreline) and the soccer fields at the Shoreline Center (owned by the Shoreline School District).

Surface Water Collection Systems

Table 3.5-5 summarizes surface water facilities managed and maintained by the City of Shoreline, from the City's Surface Water Master Plan.

Within the subarea, there are approximately 11,500 feet of surface water pipes less than 8" in diameter, 64,500 feet of surface water pipes between 8" and 18" in diameter, and 5,900 feet of pipes larger than 18-inches in diameter.

Although the City of Shoreline has only been incorporated since 1995, the area encompassed by the city was largely developed in the 1960s and 1970s. Consequently, the age of the majority of the City's surface water infrastructure is greater than 40 years.

Table 3.5-5 Surface Water Drainage System Infrastructure

Drainage System Component	Estimated Quantity	Unit
Surface water pipe	500,000 (95)	Linear Foot (LF) (Miles)
Catch Basins	5,500	Each
Ditches	180,000 (34)	LF (Miles)
Outfalls (to open water courses)	60	Each
Outfalls (to Puget Sound)	Unknown	Each
Retention and Detention Facilities Maintained by the City	95	Each
Retention and Detention Facilities (privately maintained)	219	Each
Lift Stations	2	Each

Since the life expectancy of this type of infrastructure (pipes and catch basins), is estimated at 50 years, the majority of the surface water infrastructure in the city is at or approaching its useful life expectancy.

The majority of pipes within the subarea are concrete, with a number of corrugated metal pipes south of NE 180th Street, and east of I-5.

Many of the streets within the subarea do not possess curb and gutter. Surface water is conveyed through a series of ditches, swales, and sheet flow on private lawns. If development is projected within the subarea, many of these streets will be improved to accommodate higher volumes of vehicles and pedestrians, and may be developed into a more urban street network. When this occurs, many of the ditches and sheet flow dispersion areas will be converted to curb gutter and sidewalk, requiring installation of an enclosed pipe network, with detention and treatment facilities. The majority of ditches within the subarea are along 5th Avenue NE, NE 194th Street, and NE 195th Street. If pedestrian improvements are made to these streets, the majority of these ditches will become piped, or converted to bioswales or other Low Impact Development stormwater feature.

Current Demand

As part of this study, surface water runoff within the subarea was estimated using the Rational Method. The analysis provided an estimated volume and discharge through the City's surface water conveyance system within the subarea during a 25-year storm event, for each zoning option. Percent impervious surface area for the subarea under current conditions was compared to proposed improvements. In order to assess surface water runoff generation within the subarea, this analysis references the Seattle Public Utilities methods for computing stormwater fees for residential units within the City of Seattle and neighboring communities. The SPU stormwater fee structure provides a relative impervious surface area based on average lot size and type of development. The EIS study estimated the amount of stormwater reaching the municipal surface water collection system for each customer class. The analysis undertaken was for EIS planning purposes only. The purpose of the study was to receive a relative understanding of the increase in surface water discharge potential zoning increases will have on the current surface water collection system. The analysis performed has no bearing on the existing Surface Water Master Plan. Actual improvements and exact upsizing of sections of infrastructure will not be known until extensive hydraulic modeling is completed for the subarea.

Table 3.5-6 depicts the percentage of impervious surface area for residential homes, based on size.

Commercial and institutional development was analyzed based on the assumption that the majority of these developments will have similar impervious surface areas to very heavy residential units. Under this assumption the average runoff factor would be 0.76 (76 percent impervious).

The City of Shoreline's surface water conveyance system was analyzed using the Rational Method, based on a 25-year storm event, and the percent of impervious surface area for each zone. Calculations by area (in acres) were multiplied by the applicable average runoff factor in Table 3-5.5 for each zoning/density type. (Example: R-6 zone = 7,000 to 10,000 square foot lots, and has an average runoff factor of 0.48.)

Assumptions were based on Chapter 3 of the 2009 King County Surface Water Design manual, a 24-hour precipitation factor of

2.6 based on current 25-year isopluvial maps, and an average runoff time of concentration of 30-minutes. Surface water runoff rates were based on the following calculation: Total Flow = Runoff Factor x Area (acres) x 2.6 (25-year storm precipitation amount in inches) x 0.29 (peak runoff factor for a 30-minute time of concentration – Equation 3-4 of the 2009 King County Stormwater Design Manual). The total estimated runoff from the subarea, under existing conditions is 224.70-cubic feet per second (CFS), from the 25-year storm event.

Table 3.5-6—Impervious Surface Area for Residential Homes

Small Lot Residential

Class	SF	% Impact	Avg. Runoff Factor
Tier A	<3,000	N/A	0.65
Tire B	3,000 to < 5,000	N/A	0.53
Tier C	5,000 to < 7,000	N/A	0.51
Tier D	7,000 to < 10,000	N/A	0.48

General Service/Large Lot Residential

Undeveloped	Regular	0-15%	0.18
	Low Impact	0-15%	0.31
Light	Regular	16-35%	0.32
	Low Impact	16-35%	0.41
Moderate	Regular	36-65%	0.43
	Low Impact	36-65%	0.53
Heavy		65-85%	0.66
Very Heavy		86%-100%	0.76

3.5.1 d Electricity

Electricity is supplied by Seattle City Light. The Seattle City Light service area includes all of the City of Seattle, portions of the cities of Burien, Tukwila, SeaTac, Shoreline, Lake Forest Park and Renton, as well as portions of unincorporated King County.

Electricity Sources

Seattle City Light obtains energy from a mix of sources. **Table 3.5-7** shows the distribution of energy sources used by Seattle City Light.

Table 3.5-7 Energy Sources Used by Seattle City Light

Generation Type	Percentage
Hydroelectric	89.8% *
Nuclear	4.4%
Wind	3.9%
Coal	0.8%
Landfill Gases	0.5%
Other	0.6%

*50% from the Skagit and Pend Oreille Rivers

Transmission Corridor

The transmission corridor servicing the City of Shoreline runs southeast through tracts and easements through Snohomish County until it reaches NE 185th Street, within the City of Shoreline. At NE 185th Street, the transmission corridor turns due south and runs parallel to 8th Avenue NE, adjacent to the eastern edge of the subarea. The transmission corridor continues to

parallel 8th Avenue NE, as it connects into its main service area within the City of Seattle.

Distribution Network

Seattle City Light does not provide service area maps of their distribution network. The distribution network within the subarea is currently a mix of overhead and underground facilities. The majority of the area is serviced by overhead electricity lines, which share the space with telecommunication networks within the area. Typically transferring electricity lines from overhead to underground occurs only when either building setbacks are too tight to allow overhead lines, new developments pay for undergrounding within their development area, cities undertake capital improvement projects (CIPs), or neighborhoods agree to pay for underground improvements. There is current work being done to underground a large portion of lines between NE 145th Street and NE 205th street, along Aurora Avenue N.

Current Demand

Current demand projections are based on a study prepared by the US Energy Information Administration. In 2009, a nationwide survey was conducted, depicting residential energy usage for different demographics throughout the United States. According to the survey, residents in Washington used on average 5 percent less electricity per capita that the average for all Pacific Coast users. Based on an average 2.4 persons per household, the average household uses 31.84 million British Thermal Units (BTUs) per year. This equates to 87.23 thousand BTUs per household per day. The total residential demand currently projected within the subarea is 693 million BTUs per day.

Commercial energy demands were based on a US Department of Energy survey of various commercial, government, and institutional building usage types. **Table 3.5-8** presents a summary of the information.

Table 3.5-8 US Department of Energy Survey on Energy Demand Commercial Sector Energy Consumption, March 2012

Building Type	Thousand BTUs/SF/Year
Health Care	345.9
Food Sales	535.5
Lodging	193.1
Office	211.7
Mercantile	223.6
Education	159
Service	151.6
Food Service	522.4
Religious	77
Public Order	221.1
Warehouse	94.3
Public Assembly	180
Vacant	33.1
Other	318.8
Average	**233.36**

Based on these figures, the average annual energy use for commercial developments is 233.36 thousand BTU/SF of space per year, or 0.64 thousand BTU/SF per day. The total daily commercial energy demand, based on four office workers per 1,000-square feet is 231 million BTUs per day. The total estimated

demand on the system within the subarea is 924 million BTUs per day.

3.5.1 e Natural Gas

Puget Sound Energy provides natural gas service to the residents of the City of Shoreline. The City maintains a franchise agreement (Ordinance #308) with Puget Sound Energy through October 31, 2017.

Sources

Puget Sound Energy purchases natural gas from other regions and manages the distribution of natural gas to customers within its service area. They regulate pressure, and develop and maintain distribution lines within their service areas.

PSE purchases 100 percent of the natural gas supplies needed to serve its customers. About half the gas is obtained from producers and marketers in British Columbia and Alberta, and the rest comes from sources within the Rocky Mountains.

After purchasing natural gas, PSE controls its gas supply by storing gas in large underground facilities, and withdrawing gas in the winter when customer usage is highest. PSE co-owns the largest natural gas storage facilities in the Pacific Northwest in Jackson Prairie, Washington. The storage facility can hold about 44 billion cubic feet of natural gas, and can meet up to 25 percent of the Pacific Northwest's peak demand on the coldest days in winter. PSE also stores 12.9 billion cubic feet of natural gas in a facility in Clay Basin, Utah. From these storage facilities, PSE transports gas through main pipelines to its service areas in the Puget Sound region, where it is distributed to customers in the region through 21,000 miles of service lines.

Washington State Utilities and Transportation Commission (WUTC) does not define natural gas as an essential service. Therefore, Puget Sound Energy is not required to provide services.

Extension of service is based on individual requests and the results of an analysis to determine if revenues from a developer extension will offset the cost of construction. Overall, Puget Sound Energy does not foresee any problems that would limit the supply of natural gas to the City of Shoreline in the future.

Transmission Main

Natural gas is currently supplied to most areas within the City of Shoreline through 136 miles of natural gas mains. Gas flows through the system through a 16 inch high pressure force main located along 10th Avenue NE continuing west along NE 180th Street, and south along 5th Avenue NE. As of December 2011, Puget Sound Energy serves approximately 11,556 customers in the City of Shoreline with natural gas.

Distribution Network

Within the subarea, 6-inch high pressure mains run along Aurora Avenue N, NE 185th Street, 8th Avenue N, NE 190th Street, N 175th Street, and 5th Avenue NE. The majority of residential connections are through 5/8 inch laterals. A series of 1-1/4" to 4" distribution mains stem off the 6" transmission mains, serving all sides within the subarea. **Figure 3.5-4** illustrates existing natural gas service in the subarea.

Current Demand

Puget Sound Energy serves approximately 760,000 natural gas customers in 10 counties within Washington State. Natural gas connections are extensive within the subarea. No demand quantities are presently available. However, the current configuration adequately services the subarea. Upsizing lines and connecting stub-outs to form loops may be necessary if the area is further developed.

3.5.1 f Communications

Purveyors

According to the Shoreline Comprehensive Plan, there are multiple communications companies operating within the City of Shoreline. Service within the city is provided through a network of overhead and underground services. Service providers that serve residential and commercial customers in the vicinity of the subarea are summarized below.

Comcast

Comcast provides land-line cable television, internet service, and Voice over Internet Protocol (VoIP) or digital telephone service. The City of Shoreline maintains a franchise agreement with Comcast to maintain and operate their cable and fiber optic network within the city limits. Comcast currently serves the entire City of Shoreline. No maps of Comcast's distribution network are currently available.

Frontier Communications

Frontier Communications provides land-line cable television, internet service, VoIP, and local telephone service to the community. The City of Shoreline maintains a franchise agreement with Frontier Communications to maintain and operate their cable and fiber optic network within the city limits. There is currently no franchise agreement with Frontier for the local telephone service. Frontier Communications serves the area west of Meridian Avenue N and north of N 160th Street/NW Innis Arden Way. Currently their footprint within the subarea is relatively small, only serving the four blocks west of Meridian Avenue N, along N 185th Street. They recently completed a project within the City of Shoreline installing fiber cable in their service area. According to an email from their network engineer, Jeremy Fallt, their current demand is very low. Within their service area, they have a residential and commercial customer demand of approximately 25 percent for broadband, 15 percent for TV, and 20 percent for phone. Their phone cable and fiber networks were built to handle a capacity of 100 percent within the service area. There are no forecasted projects or plans for growth in the near future.

CenturyLink

CenturyLink provides local telephone service to the area east of Meridian Avenue N, and south of N 160th Street/NW Innis Arden Way. CenturyLink serves the majority of the population within the subarea, serving everyone west of Meridian Avenue N. Currently, they do not have a franchise agreement with the City of Shoreline.

Integra Telecom

Integra Telecom provides a fiber optic data network within the City of Shoreline. They have a franchise agreement with the City through July 24, 2026. They primarily serve commercial and institutional users. Their network passes through the subarea along 8th Avenue NE and NE 180th Street along a series of overhead wires before going to an underground conduit east of 12th Avenue NE. Currently there are very few end users within the City of Shoreline. With the potential for future growth within the subarea, Integra Telecom has the potential for more service connections and possibly expanding their network in the future.

Zayo Group (formerly AboveNet Communications)

Zayo Group provides a fiber optic data network within the City of Shoreline. Prior to being purchased by Zayo Group, AboveNet Communications had a franchise agreement with the City of Shoreline, through September 9, 2021. Zayo Group is a global provider of bandwidth infrastructure services, including dark fiber, wavelengths, SONET, Ethernet, and IP services. They have network in seven countries and 45 states. They primarily serve commercial and institutional users. Their network currently does not encroach upon the subarea.

Zayo Group owns a Metro Dark Fiber run along the west coast of the United States. The run continues along Aurora Avenue N, just west of the subarea limits. The dark fiber provides a secure major bandwidth fiber optic connection for commercial and institutional users. They are currently constructing a connecting fiber run along NE 165th Street, just south of the study limits, and along 244th Street SW, north of the study limits, which connects to their main Metro Dark Fiber run along Aurora Avenue N. Along with Integra Telecom, Zayo Group has the potential for future service connections within the subarea, if future commercial development growth occurs.

Communications Network

Figure 3.5-5 at the end of this section shows partial mapping of existing communications lines located within the subarea, as made available for this analysis. There are extensive communication lines and facilities located in the subarea that are not shown in the figure because this information was not made available for the purposes of this analysis.

Undergrounding of Utility Lines in the City of Shoreline

It is the goal of the City of Shoreline to facilitate undergrounding of utilities including power and communications lines in order to promote the health, safety, and general welfare of the residents of the community by:

- Removing potential hazards and blockages from the right-of-way;
- Achieving a more aesthetically pleasing community while improving property values; and
- Decreasing the vulnerability of service delivery due to the effects of natural disasters and storm events.

A specific policy of the 185th Street Subarea Plan calls for developing a strategy for undergrounding overhead utilities in the subarea. As more capital improvements occur within transportation rights-of-way to facilitate future growth, more of

the current overhead utilities could be relocated underground in coordination with the utility providers.

3.5.2 Analysis of Potential Impacts

3.5.2 a Impacts Common to All Alternatives

All four alternatives within the subarea would result in some population growth. Any growth within the city would ultimately require some improvements or upsizing of utilities to serve projected demands within the subarea. Recommended improvements within this study are based on a planning level of analysis of each utility in relation to the area of rezoning and projected growth. The following recommendations represent an estimate of improvements likely to be necessary within the subarea under any of the action alternatives.

Once the rezoning is adopted, each utility provider would be responsible for conducting more detailed hydraulic modeling reflecting projected changes in land use in the subarea. With the more detailed hydraulic modeling, upsizing and other facility improvement needs would be confirmed more definitively. The following improvements would need to be implemented regardless of which alternative is adopted.

Water

The North City Water District contains many 6" diameter water mains with dead end stub outs. These pipes may need to be upsized to provide adequate fire suppression if development occurs within the North City Water District region of the subarea.

Fire suppression is currently adequate within the Seattle Public Utilities service area. Two fire hydrants currently provide less than 2,000 gpm of fire flow. The International Fire Code (IFC), Appendix B requires a minimum of 1,000 gpm of fire flow suppression. Additional demand on the system could prevent these water mains from producing adequate fire suppression in the future. One fire hydrant is located at the intersection of N 180th Street and 2nd Avenue NE on an 8-inch dead end line. This line may need to be connected in a loop to continue to provide adequate fire flow if additional demand is incurred on the system from future developments. The other fire hydrant is located north of the intersection of N 180th Street and Sunnyside Avenue N. This hydrant is located on a 6" line. This water main may need to be upsized and or connected into a loop. The Seattle Public Utilities also contains many water mains 6" or less in diameter, which end in dead-end stub outs, many of which do not currently contain fire hydrants. If new developments within the Seattle Public Utilities region of the subarea require a higher level of fire suppression, these pipes may need to be upsized and include additional fire hydrants.

Wastewater

All mainline pipes within the subarea are 8" in diameter or larger. Many of the 8" diameter pipes may need to be upsized to provide suitable collection capacity for sewer flows from new developments if the subarea is rezoned and demand is increased. Refer to Section 3.5.2b for an in-depth analysis of demand impacts for each rezoning alternative. According to a phone

conversation with a representative from Ronald Wastewater District, there are three sewer lift stations serving the subarea. These lift stations handle a significant portion of the sewer capacity within the subarea. New demand put on the system may require upsizing these lift stations.

Ronald Wastewater District pays for wastewater treatment for discharging wastewater to the King County's West Point Treatment Plant and the City of Edmonds Treatment Plant. Greater flow through the sewer system will incur greater charges from the perspective of the treatment plant for accepting additional wastewater.

Surface Water

Since the majority of surface water collection pipes are reaching the end of their serviceable life, an active capital improvement plan should be adopted to replace damaged or undersized pipes.

In order to adequately capture surface water from the surrounding area, the 11,500 feet of surface water pipes less than 8" will most likely need to be upsized to handle projected storm flows. Additionally, if any development occurs along 5th Avenue NE, NE 194th Street, or NE 195th Street, pedestrian improvements will most likely be installed, requiring installation of surface water facilities for approximately 5,000 feet, including but not limited to piped stormwater conveyance pipes, pervious pavement, or bio-retention swales within roadside planters.

Electricity

No capacity constraints were provided for the electricity network within the City of Shoreline. New development within the subarea may require sections of the overhead electricity lines to be placed underground. Costs for undergrounding projects are typically placed on the developers, unless the project is part of a capital improvement project undertaken by the City, in which all utilities are required to be placed underground to accommodate the City's roadway improvements.

Natural Gas

No demand projections were available under existing conditions, so the capacity of the network could not be analyzed. In order to better serve future development within the subarea, many of the smaller gas mains could be connected to form loops. This information is based on observation. Future improvements and additions to the natural gas network are based solely on future customer requests for service.

Communications

None of the communications providers provided demand projections within the subarea, so the capacity of each network could not be analyzed.

Frontier Communications recently completed a major utility project within the City of Shoreline. They do not anticipate any improvements in the foreseeable future. The company currently serves only the western portion of the subarea, west of Meridian Avenue N. Their system is currently serving 25 percent of their projected capacity. They have the ability to take on 300 percent more customer base within their portion of the subarea.

Integra Telecom and Zayo Group serve primarily commercial and institutional customers. Under Alternative 2, 3, or 4, considerably

more commercial development is projected within the subarea. With additional commercial development, these communication networks may extend their branch lines further within the subarea. Future improvements are based on forecasted development and future customer request for service.

The only expense projected for communication networks is undergrounding their facilities that currently share poles with overhead electricity lines. Communication networks will be required to place their systems underground if developers or the City of Shoreline decides to underground existing utilities within a section of the city.

3.5.2 b Future Growth Demand Forecasting

Future growth demand forecasting for each utility was performed by Otak, Inc. The analysis is based on an estimated utility demand multiplied by projected residential and commercial population forecasting for each zoning alternative. The demand forecasting is used specifically for this EIS analysis for the subarea based on a planning level of analysis. Detailed hydraulic modeling would need to be completed by utility providers in the future as part of updating comprehensive plans/master plans. Demand was forecast for build-out of each alternative. Recommended mitigation measures (including improvements) needed to serve build-out, as well as the next twenty years of growth through 2035, are presented later in this section.

Water

Estimated water demand rates were projected for the four alternatives for the projected population in 2035, based on per capita demand rates discussed in section S.5.1a of this analysis. **Table 3.5-9** shows the demand for water related to the alternatives.

This analysis, as that for other utilities, was based on review of projected development and population within Traffic Analysis Zones (TAZs) served by the Seattle Public Utilities and North City Water District. Referencing of TAZs, which correlate to census tract population data, is a common practice in planning and assessment of potential impacts as part of environmental analysis. A map of the TAZs related to the subarea and included in the analysis is provided as **Figure 3.5-6** at the end of this section. Refer to this map in review of the discussion below, which describes assumptions related to TAZ areas.

The following recommendations for each alternative are based on a planning level of analysis of the system and review of supply and demand presented in the most current Comprehensive Plan for both the Seattle Public Utilities and North City Water District. Once the rezoning has been adopted for the subarea, both the North City Water District and Seattle Public Utilities would need to update their hydraulic model in congruence with their comprehensive master plans to determine exact upsizing and necessary improvements required to serve the forecasted population and land use.

Alternative 4—Preferred Alternative

Complete build-out of Alternative 4—Preferred Alternative would potentially increase water demand up to 670 percent of the current demand within the system. All zones with the exception of TAZ 66 are projected to increase in demand substantially over existing conditions. The North City Water District is projected to see a 640 percent increase in demand within the subarea. The Seattle Public Utilities is projected to see a 690 percent increase in demand within the subarea. All 6" diameter pipes within the subarea would most likely require upsizing to 8" to 12" pipes, and dead-end mains should be connected into a loop to provide adequate pressure and fire suppression throughout the subarea. Increasing demand by nearly seven times the current water demand projected within the subarea may have an affect beyond just the distribution system. Hydraulic modeling should occur on all source of supply, booster stations, and storage reservoirs to verify supply would be adequate for the projected population.

Alternative 3—Previous Most Growth

Complete build-out of Alternative 3—Previous Most Growth would potentially increase water demand up to 520 percent of the current demand within the system. The 30" steel transmission main located along N 185th Street would most likely be of sufficient diameter for water transport; however, the age of the pipe should be considered for future development along N 185th Street. Although there have been no analysiss of problems with this transmission main, the main was installed in 1955. The distribution mains spanning off this 30" transmission are primarily 6" to 8" mains, within the Seattle Public Utilities service area. The majority of lateral mains stemming off the transmission main would most likely need to be upsized to provide adequate fire suppression and peak daily demand to areas within the subarea. The majority of zones forecasted to produce higher demands are located within the North City Water System, with the exception of TAZ 38, which is served by the SPU water system. The zones within the North City Water District that are projected to see the greatest increase in water demand are TAZ 124 and TAZ 126 with over 2,000 percent increase over existing conditions respectively in each zone. TAZ 38 is projected to increase demand by approximately 8,500 percent over current demand projections. Upsizing would need to occur around TAZ 38 within the SPU water system and most likely TAZs 11, 124, and 126. The only zones that do not forecast high water demand increases are TAZs 66, 79, and 125.

Alternative 2—Some Growth

Complete build-out of Alternative 2—Some Growth would potentially increase water demand up to 200 percent of the current demand within the system. As under Alternative 3, the 30" steel transmission main and associated piping, located along N 185th Street, likely would have capacity to serve Alternative 2; however, the age of the pipe should be considered.

Very few pipes extend into TAZ 38, which is projected to increase demand by 2,275 percent over the current demand. TAZ 38 is located between the service areas of Seattle Public Utilities and North City Water District; however, it is currently served solely by the Seattle Public Utilities. Pipes within this zone would need to be connected into a loop and most likely upsized in order to provide adequate fire suppression and peak daily demands within this zone. Coordination between the two water systems may be necessary to meet the projected demands under this scenario.

The zones that do not forecast high water demand increases are TAZs 11, 36, 37, 40, 66, 79, 125, and 127.

Within the Seattle Public Utilities service area of the subarea, approximately 7,200 feet of water mains are less than 6" in diameter. In order to adequately provide fire suppression, these mains may need to be upsized under Alternative 2, 3, or 4. The majority of undersized mains are located along N 183rd Street, from Meridian Avenue N past the boundary of the subarea to the intersection of Midvale Avenue N, and the residential neighborhood north of N 185th Street between 1st Avenue NE and Meridian Avenue N.

Within the North City Water District service area of the subarea, approximately 8,400 feet of water mains are 6" diameter dead end mains. In order to adequately provide fire suppression and adequate pressure as demand increases under Alternative 2, 3 ,or 4, the majority of these mains may need to be upsized or connected into a loop.

Table 3.5-9—Demand for Water Service, All Alternatives

	EXISTING CONDITIONS	ALTERNATIVE 1—NO ACTION		ALTERNATIVE 2—SOME GROWTH		ALTERNATIVE 3—PREVIOUS MOST GROWTH		ALTERNATIVE 4—PREFERRED ALTERNATIVE	
	Total Water Demand (gpd)	Total Water Demand (gpd)	% Growth from Existing	Total Water Demand (gpd)	% Growth from Existing	Total Water Demand (gpd)	% Growth from Existing	Total Water Demand (gpd)	% Growth from Existing
Seattle Public Utilities:									
Totals	310,892	351,716	13%	1,171,165	277%	2,367,524	662%	2,461,848	692%
North City Water District:									
Totals	358,288	394,880	10%	771,281	115%	1,768,981	394%	2,658,790	642%
Total of Both Water Systems	669,180	746,595	12%	1,942,446	190%	4,136,504	518%	5,120,637	665%

Alternative 1—No Action

Based on water demand projections and population growth rates for 2035, implementation of Alternative 1—No Action would have little to no effect on the existing water system. The TAZ with the most improvements will be TAZ 7, with a 43 percent increase in growth. One water line in this zone is a 200-foot-long 4" dead-end main on N 185th Court. Currently, no fire hydrant is located at the end of this water main. If new developments at this location require a higher level of fire suppression than is currently provided, the line will need to be upsized.

Wastewater

Estimated wastewater demand rates were projected for the four alternatives for the projected population in 2035, based on per capita demand rates discussed under 3.5-1b in this section. The following recommendations for each alternative are based on a visual analysis of the system and review of supply and demand presented in 2010 Comprehensive Sewer Plan for the Ronald Wastewater District. Once the rezoning alternative has been decided upon for the subarea, Ronald Wastewater District will need to update their hydraulic model in congruence with its comprehensive master plan to determine exact upsizing and necessary improvements required to serve the forecasted population. **Table 3.5-10** shows the demand for wastewater related to the alternatives.

Alternative 4—Preferred Alternative

Complete build-out of Alternative 4—Preferred Alternative would have the greatest effect on the wastewater collection system within the subarea, with a 661 percent increase in flow rates over the existing system. The only TAZs that would not be dramatically affected by the Alternative 4—Preferred Alternative would be TAZs 66 and 125. Wastewater demand would not just be concentrated along N/NE 185th Street, but would expand throughout the study area to NE 195th Street, and south to NE 175th Street. Demand increase would affect nearly all the side streets within the subarea, and may require upsizing multiple sections of pipes 8" in diameter and above, as well as upsizing the three lift stations serving the subarea.

Alternative 3—Previous Most Growth

Complete build-out of Alternative of Alternative 3—Previous Most Growth would have significant effect on the wastewater collection system within the subarea, with a 508 percent increase in flow rates over the existing system. The only TAZs that would not be dramatically affected by the Alternative 3—Previous Most Growth would be TAZs 66 and 125. Similarly to Alternative 2, the majority of wastewater demand would be concentrated along N/NE 185th Street. However, demand increase would affect nearly all the side streets within the subarea, and may require upsizing multiple sections of pipes 8" in diameter and above, as well as upsizing the three lift stations serving the subarea.

Alternative 2—Some Growth

Implementation to complete-build out of Alternative 2—Some Growth would have a dramatic effect on the wastewater collection system within the subarea, with a 92 percent increase in flow rates over the existing system. The majority of demand would be centered along N/NE 185th Street, forecasting wastewater demand rates at a 1,877 percent demand increase in TAZ 38 and a 559 percent increase in TAZ 124.

The majority of sewer mains within the subarea are 8" gravity mains. With the increase in projected demand under any of the alternatives (Alternative 2, 3, or 4), a large number of sewer mains may need to be upsized.

Alternative 1—No Action

Based on wastewater demand projections and population growth rates for 2035, implementation of Alternative 1—No Action

would have little to no effect on the wastewater system, with 11 percent increase in projected demand over the existing system. The TAZ with the most improvements will be TAZ 7, with a 44 percent increase in growth. Growth projections for Alternative 1—No Action should not require the upsizing of any pipes within the system.

Table 3.5-10—Demand for Wastewater Service, All Alternatives

	EXISTING CONDITIONS	ALTERNATIVE 1—NO ACTION		ALTERNATIVE 2—SOME GROWTH		ALTERNATIVE 3—PREVIOUS MOST GROWTH		ALTERNATIVE 4—PREFERRED ALTERNATIVE	
	TOTAL SEWER DEMAND (gpd)	TOTAL SEWER DEMAND (gpd)	% Growth from Existing	TOTAL SEWER DEMAND (gpd)	% Growth from Existing	TOTAL SEWER DEMAND (gpd)	% Growth from Existing	TOTAL SEWER DEMAND (gpd)	% Growth from Existing
Totals	788,063	878,317	11%	1,516,803	92%	4,787,862	508%	6,000,172	661%

Surface Water

Surface water management is not directly impacted by population; however, more development will produce larger areas of impervious surface, reduce the discharge time for surface water to enter city facilities, and generally increase stormwater runoff. Because the subarea was developed before adoption of stormwater standards drainage problems currently exist.

New redevelopment projects would be subject to Department of Ecology regulations for flow control and water quality. (Refer to discussion under 3.5.3b later in this section.) Integration of low impact development (LID) and green infrastructure into redevelopment projects can help developed areas manage stormwater like natural systems. Bioswales, rain gardens, and other features capture and retain water onsite, allowing time for it to soak into the soil, where it is naturally filtered. This process also captures pollution and improves water quality. LID treatments are encouraged by policies in the City's Comprehensive Plan, as well as in this Subarea Plan, and are required by Code.

Surface water management demand, based on precipitation rates for the 25-year peak storm event discussed in section 3.5.1c of this analysis, and percent impervious surface area for each zoning alternative is shown in **Table 3.5-11**.

Alternative 4—Preferred Alternative

Alternative 4—Preferred Alternative is projected to create an increase of surface water flow by 37 percent over existing conditions, for a total 25-year peak storm runoff rate of 303 cfs. This does not mean that additional flooding would occur; it means that new redevelopment projects would be required to control and manage the additional flow to levels regulated by the DOE and City of Shoreline. The TAZs projected to see the most increase in storm flow runoff would be TAZs 7 with an increased surface water generation of 6.5 cfs over existing conditions, 34 with an increase of 20 cfs, 36 with an increase of 8 cfs, 37 with an increase of 8 cfs, and 132 with an increase of 6.4 cfs.

Alternative 3—Previous Most Growth

Alternative 3—Previous Most Growth is projected to create an increase of surface water flow by 21 percent from existing conditions, for a total 25-year peak storm runoff rate of 272 cfs. The TAZs projected to see the most increase in storm flow runoff would be TAZs 64, 124, 126, 131, and 132.

Alternative 2—Some Growth

Alternative 2—Some Growth is projected to create an increase of surface water flow by 12 percent from existing conditions. The TAZs projected to see the most increase in storm flow runoff would be TAZs 64, 124, and 126. The entire subarea is projected to see a 25 cfs increase in storm flow.

Alternative 1—No Action

Alternative 1—No Action was assumed to have the same surface area as the existing system. Currently, the majority of the subarea is zoned R-6, and would remain so under Alternative 1—No Action. The total projected flow rate for Alternative 1—No Action would be 224.70 cubic feet per second (cfs) of storm water runoff for the peak 25-year storm event. TAZs 36, 37, and 38 are projected to have the highest surface water discharge rates of 39 cfs, 26 cfs, and 23 cfs respectively.

Under Alternative 1—No Action, there would be limited redevelopment requiring LID techniques or investment in stormwater capital projects, so existing drainage issues would continue.

Table 3.5-11—Demand for Surface Water Management, All Alternatives

	ALTERNATIVE 1—NO ACTION	ALTERNATIVE 2—SOME GROWTH		ALTERNATIVE 3—PREVIOUS MOST GROWTH		ALTERNATIVE 4—PREFERRED ALTERNATIVE	
	Flow (cfs)	Flow (cfs)	% Growth from Existing	Flow (cfs)	% Growth from Existing	Flow (cfs)	% Growth from Existing
TOTALS	224.70	250.58	12%	271.60	21%	303.10	37%

Electricity

Estimated demand rates for electricity were projected for the four alternatives for the projected population. **Table 3.5-12** shows the demand for electricity related to the alternatives.

Alternative 4—Preferred Alternative

Alternative 4—Preferred Alternative is projected to create an increase of energy demand by approximately 700 percent from existing. All the zones are forecasted to receive a substantial increase in demand, except for TAZs 10, 64, and 66. The entire subarea is projected to generate a demand of 7.383 billion BTUs per day.

Alternative 3—Previous Most Growth

Alternative 3—Previous Most Growth is projected to create an increase of energy demand by approximately 610 percent from existing. TAZs projected to see the most increase in electricity demand are 7, 10, 11, 37, 38, 40, 124, 126, 128, 131, and 132. The entire subarea is projected to generate a demand of 6.570 billion BTUs per day.

Alternative 2—Some Growth

Alternative 2—Some Growth would generate an increase in energy demand of almost 240 percent compared to existing conditions. TAZs projected to see the most increase in electricity demand are 7, 10, 38, 124, and 126. The entire subarea is projected to generate a demand of 3.086 billion BTUs per day.

Alternative 1 – No Action

Based on energy demand projections and population growth rates for 2035 Alternative 1 – No Action would have little to no effect on the electricity system network. The TAZ with the most improvements would be TAZ 7.

Table 3.5-12—Demand for Electricity Service, All Alternatives

EXISTING CONDITIONS	ALTERNATIVE 1—NO ACTION		ALTERNATIVE 2—SOME GROWTH		ALTERNATIVE 3—PREVIOUS MOST GROWTH		ALTERNATIVE 4—PREFERRED ALTERNATIVE	
Energy (Thousand BTU/Day)	Total Energy (Thousand BTU/Day)	% Growth from Existing	Energy (Thousand BTU/Day)	% Growth from Existing	Energy (Thousand BTU/Day)	% Growth from Existing	Energy (Thousand BTU/Day)	% Growth from Existing
924,420	1,040,741	13%	3,086,199	234%	6,570,263	611%	7,383,030	699%

3.5.3 Mitigation Measures

3.5.3 a Incorporated Plan Features

Incorporated plan features include improvements to services and facilities that are already being planned by the utility providers. These are described below to the extent that information was made available by existing providers. Additional improvements to the ones listed will be necessary to accommodate future development, depending on which land use plan is implemented. Refer to Section 3.5.3c for an approximate list of improvements necessary for each alternative in relation to the affected utility. Planned utility improvements in the subarea, along with additional recommended improvements to support implementation of the action alternatives (Alternatives 4, 3, or 2) are illustrated in **Figures 3.5-7 through 3.5-10** at the end of this section.

Water

North City Water District

The following is a list of recently completed and planned capital projects within the subarea for a 30-year improvement plan. Several of these projects have already been completed.

1. Replace 660 Booster Pump Station with a new North City Booster Pump Station. The estimated cost is $4,185,000, of which $285,000 would be incurred through connection charges and rate increases, and $3,900,000 would be acquired through bonds and loans. This project is expected to start in the fall of 2014 and will take approximately 15 months. This project will lower the 660 zone hydraulic grade line to 615, expand the existing zone area, and create additional 615 zone area to the west.

   This project is located within the North City Business District, at the eastern edge of the subarea, along 15th Avenue NE, near the intersection of NE 175th Street, within TAZs 66 and 67. None of the alternatives would see much demand increase within these TAZs. Nearby zones are projected to increase demands significantly under Alternative 2, 3, or 4. If this work affects other zones within the 590 pressure zone, specifically zones 124 and 126, the improvements should be reanalyzed to verify they meet adequate capacity for the forecasted demands.

2. Recoat and install railing on the 3.7-million gallon reservoir. This work is currently under construction. The reservoir is located northeast of the intersection of NE 179th Street and 15th Avenue NE, near the eastern edge of the subarea. The 3.7-million gallon reservoir currently services the 590 pressure zone in which the North City Utility District portion of the subarea is located. The estimated cost is $300,000.

   This work benefits the largest water storage tank currently serving the North City Water District portion of the subarea. Although the CIP project mentioned does not propose an increase in storage capacity, Alternatives 2 through 4 may require an increase in water storage for the system. The DOH recommends that the storage facilities servicing a system contain two days of Average Daily Demand for all Equivalent Residential Units within

the system. All the storage reservoirs within the system contain a standby storage capacity of 5.38-million gallons.

Under Alternative 2—Some Growth, the projected demand of 1.54-million gallons of water would be required for standby storage for prospective residences within the subarea. Under Alternative 3—Previous Most Growth, the projected demand of 3.54-million gallons of water would be required for standby storage for prospective residents within the subarea. For Alternative 4 –Preferred Alternative, the projected demand of 5.32 million gallons of water would be required for standby storage. Under these alternatives, there is potential that this projected demand coupled with the demand generated by the rest of the system would require additional water storage volume.

3. Install Supply Station #4 near the intersection of 5th Avenue NE and NE 185th Street. Additionally, install 12" water mains connecting to an existing 10" main along 5th Avenue NE. This work will assist in servicing the North City Water District customers located on the west side of I-5. This work was completed in 2012; however, the proposed location of the 185th Street Light Rail Station may require this recently installed capital improvement project to be relocated elsewhere west of I5.

   This CIP project is located adjacent to TAZ 38, which is projected to see the most water demand increase within the subarea. TAZ 38 could be serviced by both the Seattle Public Utilities District and the North City Water District. Under Alternative 2—Some Growth, this area is projected to use 454,059 gpd of water. Under Alternative 3—Previous Most Growth, this area is projected to use 1,682,478 gpd, and under Alternative 4—Preferred Alternative, this area is projected to use 767,127 gpd. The pipe sizing may need to be increased along the portion of the North City Water District's western service area, west of I-5, including upsizing the existing 10" transmission main that connects the system underneath the freeway. Additional analysis may need to be completed to verify the adequacy of the pump station size in relation to the projected demands under Alternatives 2 through 4.

4. Replace 980 feet of 4" water main with an 8" water main to meet fire flow velocities at the intersection of NE 185th Street and 14th Avenue NE. This work is located near the eastern edge of the project limits. The estimated cost is $463,000. This project is projected to be constructed in 2026.

   This CIP project is located outside of the subarea; however, due to its proximity to TAZs 124 and 126, the project may need to be reanalyzed for projected demand increases, depending on which alternative is implemented. Under Alternative 2— Some Growth, these zones would increase water demand by 325,000 gpd. Under Alternative 3—Previous Most Growth, these zones would increase water demand by 936,000 gpd, and under Alternative 4—Preferred Alternative, these zones would increase water demand by 1,154,000 gpd. The pipe selection may need to be upsized to accommodate the projected demands, depending on which alternative is implemented.

5. Replace and/or relocate/remove fire hydrants on 4" and 6" dead end mains. This work is proposed throughout the entire North City Water District. The estimated cost is $1,365,000 and is projected to be an ongoing project based on need and age of existing hydrants and pipes, with an overall completion date of 2026. As capital projects are constructed and new developments are built, the North City Water District will analyze each of the dead end fire hydrants to determine if a fire hydrant needs to be replaced or upgraded as part of another project. In these situations, hydrants will be improved before 2026.

   This CIP project would improve fire flow throughout the North City Water District's portion of the subarea. Due to the increased demand projected in a number of the zones within the subarea, many of the mains may need to be upsized to 8" or larger mains to provide suitable fire flow protection under Alternative 2, 3, or 4.

Seattle Public Utilities

The SPU 2013 Water System Plan describes general funding allocation for different aspects of the water system. Due to the broad overview of the SPU 2013 Water System Plan, details were not specific to the Shoreline area, and in particular the region surrounding the subarea. The only planned capital improvement project forecasted for the near future is upsizing and replacing approximately 3,000 feet of water mains along Aurora Avenue N (Hwy 99) between N 192nd Street and N 205th Street. The original water mains are a series of 4" to 8" cast iron mains installed as early as 1946. All proposed mains will be 8" ductile iron mains. This work is located north of the subarea, and should not be affected by future demands generated by any of the alternatives.

Wastewater

The following is a list of capital improvement projects from the Ronald Wastewater District 2010 Comprehensive Sewer Plan:

1. NE 185th Street Sanitary Sewer Improvements – Replace approximately 749 feet of 8" gravity sewer main and side sewers with 10" to 15" sewer mains from 12th Avenue NE to 16th Avenue NE. The estimated project cost is $417,000.

   This CIP project would assist with projected demand flows for all alternatives. Alternative 3 or 4 potentially could increase loading to where 10" to 15" pipes may not be large enough diameter pipe for the projected flow during peak conditions.

2. 1st Avenue NE Sanitary Sewer Improvements – Replace approximately 1,321 feet of 8" gravity sewer main and side sewers with 10" mains by pipe bursting from N 185th Street to N 180th Street along 1st Avenue NE. The estimated project cost is $719,000.

   This CIP project would assist with projected demand flows for all alternatives. Based on a peaking factor of 4 times the average daily demand generation for peak hour demand, Alternative 2 may increase loading to where 10" mains may not be large enough diameter pipe for the projected flow during peak conditions. Implementation of

Alternative 3 or 4 would greatly increase loading along this pipe run, and would require upsizing to larger diameter pipe than the planned 10" mains. The forecasted loading may require upsizing to 18" or larger mains to accommodate the projected peak demand.

3. Basin 17 Sanitary Sewer Improvements – Replace approximately 2,136 feet of 8", 10", and 15" gravity sewer main and side sewers with 10", 12", 18", and 21" sewer main along NE 180th Street from 10th Avenue NE to 8th Avenue NE, along 5th Avenue NE from NE 180th Street to NE 178th Street, and along NE 175th Street, from a 15" crossing of I-5 to near Meridian Avenue N. The estimated project cost is $1,305,000.

   This CIP project is located within TAZ 126. Alternative 3 would create a 2,200 percent and Alternative 4 would create a 2,700 percent increase in demand within this TAZ. Based on a peaking factor of four times the average daily demand generation for peak hour demand, either alternative may increase loading to where the proposed pipe diameter upsizing is not adequate to serve the projected population, especially for the improvements along NE 180th Street. Increasing the pipe diameters of the proposed pipes and upsizing additional pipes within the vicinity may be necessary to facilitate the projected demand.

4. 11th Avenue NE Sanitary Sewer Improvements – Replace approximately 3,252 feet of 8" and 10" gravity sewer main and side sewers with 10" and 12" sewer main along 11th Avenue NE from NE 175th Street to NE 168th Street, up 11th Place NE, and along NE 170th Street from 11th Place NE to 14th Avenue NE. The estimated project cost is $1,792,000, and is projected to be completed in 2016.

   This project is located at the southern end of the subarea. None of the alternatives propose much rezoning or future growth around the area where this capital improvement project is intended. This project will have some benefit for future growth within the region, but should not be adversely affected by increased demand from one of the alternatives.

These projects may be dramatically affected by the land use plan implemented by the City for the subarea, and many more sewer lines within the subarea likely would require upsizing. Additional hydraulic modeling would be required to confirm needs and determine priorities.

Surface Water

Five drainage issues identified within the City's Comprehensive Plan are directly associated with the subarea. These five issues are currently in the process of being designed or financed. Future growth in the subarea may require the capacity of the proposed designs to be re-evaluated.

1. Ronald Bog – Ronald Bog receives surface water from the surrounding streets and developments, including from TAZs 7, 11, 64, 131, and 132 within the subarea. The City has completed a comprehensive examination of the problem and determined that Ronald Bog is currently undersized to handle storm flows associated with the 25-

year storm event, and floods into neighboring properties. The City has identified a series of culvert replacements, channel improvements, pipe system replacements, a flood control berm, as well as flood monitoring and early warning system.

Additional analysis should be performed to determine if increased runoff generated by the selected alternative would require additional upsizing of the bog and associated pipe network. Based on a simple Rational Analysis method of the zones within the subarea feeding to Ronald Bog, Alternative 2 would see approximately 9 cfs increase in storm generation from existing conditions, Alternative 3 would see approximately 13 cfs increase, and Alterative 4 would see 23 cfs increase. Revisions to the hydraulic modeling should be completed for the system once the zoning alternative has been selected, to verify the amount of upsizing infrastructure necessary to accommodate projected runoff to Ronald Bog.

2. 12th Avenue NE and 11th Avenue NE, from NE 175th Street to NE 170th Street – The existing drainage system within this corridor daylights on the west side of 12th Avenue NE, and discharges into residential backyards. The water is then collected in catch basins on 11th Avenue NE and conveyed to a pond located at 17201 11th Avenue NE. The pond was designed to infiltrate flows and has no outlet. This area is subject to flooding during significant events. The City is currently planning to expand the ditch along 12th Avenue NE for use as an infiltration ditch. The ditch will provide additional storage and help infiltrate runoff to attenuate the flows coming into the area.

   This CIP project is located near the southeast corner of the subarea. The two TAZs that drain toward this surface water pond are TAZ 65 and 66. Alternative 4—Preferred Alternative will have the most affect on this CIP project. However, rezoning within these zones is projected to be minimal and should only increase surface water flows by a maximum of 4 cfs over existing conditions. Additional storage or flow control facilities may be required. Inclusion of LID and green infrastructure improvements would provide additional mitigation.

3. Serpentine Pump Station near 5th Avenue NE and NE 178th Street – Serpentine drainage system is a complex set of gravity pipes and pump stations that currently does not provide a 25-year level of service for flood protection. Drainage currently accumulates at the low spot on 5th Avenue NE near NE 178th Street because the capacity of the Serpentine Pump Station is inadequate to convey the necessary flow up into the system that runs down NE Serpentine Avenue. This problem was studied under the Thornton Creek Watershed plan. Two alternative solutions were identified (ranging from $900,000 to $1.8 million). Prior to implementing one of these solutions, the City invested in low impact development (LID)/green infrastructure in the contributing basin to address the drainage problems. The City received a grant in 2010 for this project.

The pump station would be potentially impacted by rezoning of TAZ 79, 127, and a portion of 126. If the majority of surface water from TAZ 79, 127, and 126 discharges to the pump station, Alternative 3 may increase flows by 5.4 cfs, and Alternative 4 may increase flows by 56.9 cfs for the 25 year storm event. Additional storage or flow control facilities may be required once the preferred alternative has been chosen. Additional LID and green infrastructure improvements would provide mitigation.

4. 10th Avenue NE near NE 174th Street – During the December 2007 storm event, 110th Avenue NE south of NE 175th Street was flooded. Based on City observation, this is a recurrent problem. The roadway drainage system backed up and flow came up out of the catch basins on the east side of the roadway, which resulted in stormwater flowing down the driveways into garages. A preliminary solution was identified in the Thornton Creek Watershed Plan and included detention and conveyance improvements. The detention could be on the south side of NE 175th Street between 10th Avenue NE and 11th Avenue NE.

   The rezoning will have little effect on this CIP project. No major rezoning is projected within this area. Under Alternative 3 or 4, there would be zoning changes along the neighboring blocks.

5. Pump Station No. 25 (located north of N 175th Street and east of I-5) – Flooding of structures, yards, and driveways due to undersized pump station. Replace pump and force main to provide additional pumping capacity. The City received a grant to correct this problem in addition to implementing LID/Green infrastructure in the tributary basin in 2010. LID/green infrastructure improvements are also part of the project to reduce flows to the Serpentine Pump Station.

   The pump station would be potentially impacted by rezoning of TAZ 79. The subarea's boundary is located near the pump station. None of the alternatives project a large amount of growth within this zone. If the majority of surface water from TAZ 79 discharges to the pump station, Alternative 3 will increase flows by 0.5 cfs, and Alternative 4 will increase flows by 2 cfs for the 25 year storm event. Additional storage or flow control facilities may be required once the preferred alternative has been chosen. Additional LID and green infrastructure improvements would provide mitigation.

Electricity

Seattle City Light does not generate a comprehensive plan of capital improvement projects. The main project underway within the City of Shoreline is undergrounding a section of electricity lines running along the Aurora Avenue N (Hwy 99) corridor. This project will abut the subarea, but should not have any major effect on rezoning within the subarea.

Natural Gas

Puget Sound Energy does not generate a comprehensive plan of improvement projects. Additionally, Washington State Utilities and Transportation Commission (WUTC) does not define natural

gas as an essential service. Therefore, Puget Sound Energy is not required to provide service. Extension of service is based on individual requests. Overall, Puget Sound Energy does not foresee any problems that would limit the supply of natural gas to the City of Shoreline in the future.

Communications

Future Telephone Services and Facilities

According to the City of Shoreline's Comprehensive Plan, Washington Utilities Trade Commission regulations require CenturyLink and Frontier to provide adequate telecommunications service on demand; and Section 480-120-086 of the Washington Administrative Code (WAC) requires CenturyLink and Frontier to maintain adequate personnel and equipment to handle reasonable demand and traffic. Because CenturyLink and Frontier provide service on demand, there are no limits to future capacity. Additionally, telephone service should only be restricted by bandwidth constraints on fiber optic networks that provide this digital service.

Future Cable Television and Broadband Services and Facilities

Although the demand for cable television is likely to continue to increase as population grows, access to cable television in Shoreline is likely to increase at the same pace as population growth. However, the demand for broadband services, including cable television, telephone and internet services, is likely to continue to grow as networks are supported with additional bandwidth. This growth will most likely occur relative to internet service, as more content becomes accessible online, and as people continue to communicate and interact online. These broadband services can be provided over fiber optic networks, cable networks or telephone networks.

3.5.3 b Applicable Regulations and Commitments

Washington State Department of Ecology and City of Shoreline Surface Water Management Requirements

Environmental regulations pertain primarily to surface water runoff for future development. The City of Shoreline has adopted a Western Washington Phase II National Pollutant Discharge Elimination System (NPDES) Permit to control pollutant loads and reduce peak flows from developed sites and municipal facilities within the city. There are seven goals pertaining to the NPDES Permit, two of which actively affect development growth within the subarea.

NPDES Goal #4 – Controlling Runoff from New Development, Redevelopment and Construction Sites

This goal requires that the City of Shoreline develop, implement, and enforce a program to reduce pollutants in stormwater runoff from new development, redevelopment, and construction site activities. The NPDES Permit intends to make Low Impact Development (LID) the preferred and commonly-used approach to site development

A major aspect of this goal is ongoing maintenance and inspection of surface water facilities. The City is currently meeting this goal by enforcing that private developers maintain their private surface water facilities permitted since 2007. The City of Shoreline inspects several hundred surface water facilities on a rotating inspection cycle to ensure all surface water facilities are functioning as designed.

Additionally, in 2009 the City of Shoreline adopted the Department of Ecology Low Impact Development Manual, which requires that best practices be used unless shown to be infeasible.

NPDES Goal #5 – Municipal Operations and Maintenance

This goal requires that the City of Shoreline reduce potential impacts to water quality through its operations and maintenance division of public infrastructure. The Roads Division of the City of Shoreline follows guidance from the ESA Regional Road Maintenance Program Guidelines. The Surface Water Division implements a rigorous stormwater system inspection, maintenance, and cleaning program. The Parks Department adopted an Integrated Pest Management Program. Additionally, all City Maintenance Yards operate under a Surface Water Pollution Prevention Plan (SWPPP) and are regularly inspected to assure compliance with the SWPPP.

A major aspect of this goal is inspecting all municipally owned and operated catch basins and inlets at least once before August 1, 2017. Additionally, the City of Shoreline is committed to using applicable best management practices (BMPs) associated with runoff control during routine maintenance, and using a Work Order software program to track inspections and maintenance/repair activities.

These two goals are applicable to future development within the subarea, in that future growth will require additional infrastructure, both public facilities and private. Through the NPDES permit, it is encouraged to pursue LID improvements to help manage and mitigate surface water runoff. The conventional approach to manage stormwater runoff has limitations for recovering adequate storage and distributed flow paths necessary to more closely match pre-development hydrologic function and protect aquatic resources from adverse effects of development. Low Impact Development principles and applications present a significant conceptual shift from a structural approach to a source reduction approach. LID improvements utilize native soils, vegetation protection areas, and landscaping strategically distributed throughout the project to slow, store, and infiltrate storm flows. LID improvements are designed into the project as amenities, as well as hydrologic controls. Types of LID improvement include vegetated roofs, rainwater harvesting, rain gardens, permeable pavement, and bio-retention swales.

New development within the City of Shoreline will need to conform to regulations within the NPDES Permit and the Ecology LID Manual provisions of the Development Code. Development will be required to utilize LID improvements to reduce flows, infiltrate where applicable, and treat stormwater before discharging to the City of Shoreline's surface water network. The City is required to monitor these facilities to verify they are working properly, and maintain LID improvements installed within public right-of-way, unless an agreement is made with adjacent property owners.

3.5.3 c Other Potential Mitigation Measures

Water

North City Water District

Table 3.5-14 contains a list of distribution and transmission main improvements projected to accommodate future demands associated with each alternative.

The majority of the subarea is located within the North City Water District's 590 pressure zone. While the subarea is currently zoned primarily residential, redevelopment under any of the action alternatives (4, 3, or 2) would introduce more intensive residential uses as well as neighborhoods-supporting commercial/retail. This change in land use would create a substantial increase in demand within this pressure zone.

Table 3.5-14
North City Water District – Water System Upgrades

Alternative	8" Main (Feet)	12" Main (Feet)	Additional Water Storage
#1—No Action	0	0	No
#2—Some Growth	300	4,900	No
#3—Previous Most Growth	300	30,300	Yes
#4—Preferred Alternative	300	37,000	Yes
2035 Improvements	0	8,600	Yes

The North City Water District generated historical and projected water demands for the system, for each pressure zone. **Table 3.5-15** contains a comparison of the 2030 projected demand on the 590 pressure zone based on the existing growth rates, and demand estimated for the study are based on the rezoning alternatives.

According to this comparison, Alternatives 4, 3, and 2 each would generate more demand than the entire pressure zone generates. Major system improvements likely would be necessary to accommodate the influx of demand generation within the North City Water District's portion of the subarea. Improvements to the water system are determined based on projected development growth and land use type.

Table 3.5-15
North City Water District – Demand Comparison

		ADD (MGD)[1]
Pressure Zone 590 - Year 2030		0.41
Subarea	Existing Conditions	0.36
	Alternative 1—No Action	0.39
	Alternative 2—Some Growth	0.77
	Alternative 3—Previous Most Growth	1.77
	Alternative 4—Preferred Alternative	2.66
	2035 Improvements	0.54

1. MGD = Million Gallons per Day

The potential improvements for each alternative are based on a planning level of analysis of the system. Utility providers would need to conduct detailed hydraulic modeling as part of future comprehensive planning/master planning updates to determine specific upsizing and facility improvement needs. The analysis shows the potential demand on the system assuming the subarea is completely built out to the adopted zoning code.

Recommendations are based a conceptual schematic of what improvements likely would be necessary once the subarea is constructed to the limits of the proposed zoning area. Twenty year improvement needs assume that some upsizing to levels that would serve full build-out may be needed. (It is not assumed that the utility providers would continually upgrade facilities multiple times, but rather would install facilities to serve the longest periods of growth possible.) As part of future planning and analysis, utility providers would complete their own analyses to determine the appropriate phasing of improvements in the most efficient manner to serve growth over the next twenty years and beyond.

Alternative 4—Preferred Alternative

Based on a comparison of the necessary effective storage within the 3.7 million gallon storage reservoir, to 2 times the average daily demand for the subarea, additional water storage may be necessary for the full build-out of Alternative 4.The Washington State Department of Health recommends water storage reservoirs to contain standby storage equivalent to two times the system's average daily demand. Two times the average daily demand for Alternative 4 for the North City Water District's portion of the subarea is 5.32 million gallons of recommended storage. The maximum storage currently available is 3.7 million gallons. Additional water storage may be necessary at full build-out of the subarea under Alternative 4.

TAZs 124 and 126 are projected to increase demand by 2,600 percent With the increase in demand, nearly all of the existing 6" water mains may need to be upsized, and dead end mains connected into loop networks to improve pressure distribution and fire flow suppression throughout the North City Water District's portion of the subarea. Similar to Alternative 3, the existing 10" main connecting the western portion of the District's service area with the eastern portion underneath I-5, may need to be increased in diameter to a 12" main or larger to improve flow and distribute pressure through the entire area. The 10" main along 5th Avenue NE may need to be increased to a 12" main, because the area would be changing from an R-6 zone to more intensive zoning. Approximately 37,000 feet of water mains may need to be upsized to 12" diameter or larger mains to serve the projected demands. In addition, the storage reservoirs servicing the applicable pressure zones within the subarea should be analyzed to verify adequate storage is accessible to residents for fire suppression and recommended two-day standby storage if a water source becomes off line.

Twenty Year Improvements

Necessary water storage for the projected twenty year improvements for Alternative 4 is estimated at 1.09 million gallons of standby storage. An analysis of the projected water demand for the subarea combined with the surrounding community was not performed. The existing water storage reservoir may be sufficient to provide water storage to the subarea for the next twenty years; however, a hydraulic analysis will need to be performed.

The total length of pipe potentially necessary to accommodate the projected population in 2035 is approximately 8,600 feet of pipe improvements.

Recommended improvements are based on the assumption that the subarea will eventually be built-out with land uses allowed under the proposed zoning for the preferred alternative. For the purposes of this analysis, it is assumed that infrastructure upsizing to serve the twenty-year 2.5 percent growth rate may include a higher level of improvements. Upsizing may be done to accommodate the Alternative 4—Preferred Alternative at build-out conditions since the utility provider likely would not continuously upsize mains as the population continues to grow, but would upsize for the projected population. With further planning and analysis, the utility provider would determine the most cost effective and efficient method for making improvements to serve growth in the interim years up to the built-out condition.

Estimated improvements needed to serve the next twenty years of growth (but assuming full upsizing to serve build-out) include the following.

1. The following pipes may need to be upsized to 12" diameter pipes to accommodate the projected population in 2035. 12" diameter or larger pipes may be necessary under total build-out of Preferred Alternative #4.
    a. 2,130 feet along 5th Avenue NE from N 185th Street to NE 195th Street
    b. 1,330 feet along NE 193rd Street from 1st Avenue NE to 5th Avenue NE
    c. 1,100 feet along NE 192nd Street from 3rd Avenue NE to 5th Avenue NE
    d. 670 feet along NE 189th Street from 8th Avenue NE to 10th Avenue NE
    e. 670 feet along NE 188h Street from 8th Avenue NE to 10th Avenue NE
    f. 1,780 feet along NE 185th Street from 8th Avenue NE, and south along 5th Avenue NE, to NE 180th Street
    g. 920 feet along 7th Avenue NE from NE 183rd Street to NE 180th Street
    h. 210 NE along NE 183rd Street from 7th Avenue NE to 8th Avenue NE
    i. 1,700 feet along NE 180th Street, from 5th Avenue NE to 10th Avenue NE

Alternative 3—Previous Most Growth

Similar to Alternative 4, the projected demand generated from Alternative 3 in comparison to the necessary effective storage within the 3.7 million gallon storage reservoir, additional water storage may be necessary for the full build-out of the alternative. Two times the average daily demand for Alternative 3 for the North City Water District's portion of the subarea is 3.54 million gallons of recommended storage. The maximum storage currently available is 3.7 million gallons. Additional water storage may be necessary at full build-out of the subarea under Alternative 3.

Due to the projected high demands within TAZs 124 and 126, a number of the existing 6" water mains may need to be upsized, and dead end mains connected into loop networks to improve pressure distribution and fire flow suppression throughout the North City Water District's portion of the subarea. The existing 10" main connecting the western portion of the District's service

area with the eastern portion underneath I-5, may need to be increased in diameter to a 12" main to improve flow and distribute pressure through the entire area. The 10" main along 5th Avenue NE may need to be increased to a 12" main, because the area would be changing from an R-6 zone to more intensive zoning. Approximately 30,300 feet of water mains may need to be upsized to 12" diameter to serve the projected demands. In addition, the storage reservoirs servicing the applicable pressure zones within the subarea should be analyzed to verify adequate storage is accessible to residents for fire suppression and recommended two-day standby storage if a water source becomes off line.

Alternative 2—Some Growth

The majority of water mains within the North City Water District's portion of the subarea are 6" water mains. Due to demand generation within a number of the TAZs in the subarea many of the 6" mains may need to be upsized, and connected to the existing 12" transmission mains along NE 180th Street and 12th Avenue NE. Approximately 4,900 feet of mains may need to be upsized to 12" diameter to serve the projected demands. In addition, the storage reservoirs servicing the community should be analyzed to verify that adequate storage is accessible to residents for fire suppression and recommended two-day standby storage if a water source becomes off line.

Alternative 1—No Action

Improvements necessary for Alternative 1 would coincide with the Capital Improvements Plan adopted by the District. No further improvements appear necessary under Alternative 1 – No Action.

Seattle Public Utilities

Table 3.5-16 contains a list of distribution and transmission main improvements projected to accommodate future demands associated with each alternative.

Table 3.5-16
Seattle Public Utilities – Water System Upgrades

Alternative	8" Main (Feet)	12" Main (Feet)
#1—No Action	2,700	0
#2—Some Growth	7,000	13,000
#3—Previous Most Growth	5,700	20,300
#4—Preferred Alternative	5,500	30,500
#4 – 2035 Improvements	1,500	3,000

Alternative 4—Preferred Alternative

Alternative 4—Preferred Alternative would generate more demand throughout the subarea. Concentration would no longer be just along NE 185th Street, but would affect nearly all side streets and expand past the limits of the subarea within TAZs 7, 123, and 34. Upsizing mains and connecting dead end mains should occur for nearly every dead end fire hydrant under this alternative. Approximately 5,500 feet of water mains may need to be upsized to 8" diameter, and 30,500 feet of mains may need to be upsized to 12" diameter to serve the projected demands.

Twenty Year Improvements

As with recommended improvements for the North City Water District, this analysis assumes upsizing would occur to accommodate the twenty-year estimated annual 2.5 percent growth rate. The distribution system and facilities could be potentially upsized as necessary to accommodate Alternative 4 – Preferred Alternative at build-out conditions. Because it is not likely that that the utility provider would continuously upsize their mains as the population continues to grow, but would upsize at some point for the projected population. With further planning and analysis, each utility provider would further determine how improvements could be made more cost effectively in the interim years before build-out.

Water improvements in the Seattle Public Utilities system anticipated to serve the projected population in 2035 under any of the action alternatives (but typically inclusive of upsizing to serve full build-out) are described below.

The total length of pipe potentially necessary to accommodate the projected population in 2035 is approximately 4,500 feet of pipe improvements.

1. An analysis based solely on projected population growth and per capita demand projections, estimates the following pipe diameters may need to be upsized to 8" diameter pipes to accommodate the projected population in 2035. Under total build-out of Preferred Alternative #4, these pipe diameters may need to be upsized to 12" diameter pipes.
    a. 890 feet along Sunnyside Avenue N from the north end to N 180th Street
    b. 240 feet along N 186th Street from east end to Corliss Avenue N

2. The following pipes may need to be upsized to 8" diameter pipes to accommodate the projected population in 2035. 8" diameter or larger pipes may be necessary under total build-out of Preferred Alternative #4.
    a. 180 feet along N 185th Court to the intersection with Midvale Avenue N.
    b. 170 feet along N 187th Street from west end to 1st Avenue NE

3. The following pipes likely would need to be upsized to 12" diameter pipes to accommodate the projected population in 2035 (12" diameter or larger pipes may be necessary to serve build-out of Preferred Alternative 4).
    a. 1,160 feet along 3rd Avenue NE from N 185th Street to NE 180th Street to connect the pipe network into a loop
    b. 650 feet along Ashworth Avenue N, from N 185th Street to N 183rd Street
    c. 650 feet along 1st Avenue NE from N 187th Street to N 185th Street
    d. 560 feet along NE 180th Street from 3rd Avenue NE to 1st Avenue NE
    e. 170 feet along 3rd Avenue NE from north end to NE 185th Street

Alternative 3—Previous Most Growth

Similar to Alternative 2—Some Growth, demand generation under Alternative 3—Previous Most Growth would be concentrated along NE 185th Street, where rezoning would change the area

from an R-6 to an MUR-45 zone. The majority of water main upsizing would be mains stemming off the existing 30" transmission main along NE 185th Street. Upsizing of mains would especially be necessary adjacent to TAZ 38, where the largest increase in water demand is projected. A 6" distribution main along NE 183rd Street may need to be upsized to an 8" or 12" main due to the zoning increase from R-6 to R-48. Approximately 5,700 feet of water mains may need to be upsized to 8" diameter, and 20,300 feet of mains may need to be upsized to 12" diameter to serve the projected demands.

Alternative 2—Some Growth

Demand generation would be concentrated along NE 185th Street. The majority of water main upsizing would be mains stemming off the existing 30" transmission main along NE 185th Street to accommodate the rezoning from R-6 to more intensive zoning. Upsizing of mains would especially be necessary adjacent to TAZ 38, where the largest increase in water demand is projected. A 6" distribution main along NE 183rd Street may need to be upsized to an 8" main to accommodate demands within the subarea. A number of the dead end distribution mains within TAZ 36 are 4" diameter pipes. In order to accommodate projected demand increases along the southern half of this zone, many of these mains should be upsized to 8" water mains. Approximately 7,000 feet of water mains should be upsized to 8" diameter, and 13,000 feet of mains should be upsized to 12" diameter to serve the projected demands.

Alternative 1—No Action

Approximately 2,700 feet of water mains may need to be upsized to 8" mains or connected into a loop system to provide suitable fire suppression to two fire hydrants in TAZ 132.

Wastewater

Table 3.5-17 contains a list of sewer main improvements projected to accommodate future demands associated with each alternative.

Table 3.5-17
Ronald Wastewater District – System Upgrades

Alternative	12" to 15" Main[1]	18" or Larger Main[2]	Upsize Lift Station #
#1 — No Action	0	0	None
#2 — Some Growth	11,300 ft	0	15
#3 — Previous Most Growth	11,300 ft	20,800 ft	8, 14, 15
#4 — Preferred Alternative	26,600 ft	32,500 ft	8, 14, 15
2035 Improvements	648 ft	10,100 ft	15

Alternative 4—Preferred Alternative

Alternative 4—Preferred Alternative is projected to increase demand throughout the subarea. Approximately 26,600 feet of

12" diameter pipe and 32,500 feet of 18" diameter pipe may need to be installed in new runs or upsized from existing 8" diameter mains to accommodate projected flows from the estimated population under Alternative 4.

A trunk main collects wastewater from the majority of the subarea, from as far north as NE 190th Street, as far west as Ashworth Avenue N, and as far east as 15th Avenue N. This trunk main is the main sewer main for basin #23 within the Ronald Wastewater District. The sewer main begins at NE 185th Street and Meridian Avenue NE as a 24" main. Under peak hour conditions, it is estimated that this trunk main can collect as much as 13.6 cfs from the subarea under build-out conditions of Alternative 4. The 24" trunk main was assumed to be of adequate size to handle this capacity, though with additional flows from outside of the subarea, the pipe will need to be analyzed to verify it's flow capacity. At NE 161st Place and Corliss Avenue NE, the pipe reduces in diameter to an 18" pipe, to the intersection of NE 155th Street. Approximately 1,660 feet of pipe may need to be upsized to 24" or larger diameter pipe to accommodate the projected flows from the subarea and the surrounding community.

Sewer improvements are projected along most side streets, including upsizing 3,100 feet of 8" mains upsized to 18" mains along Corliss Avenue N and Meridian Avenue N, from N 194th Street to N 185th Street, and 10,400 feet of pipe upsized to 12" mains along all side streets and cul-de-sacs from Meridian Avenue N to 5th Avenue NE. Major pipe improvements are projected along N 185th Street to accommodate the increase in demand, including upsizing 2,800 feet of pipe from 8" pipe to 18" diameter pipe from Stone Avenue N to 1st Avenue NE, and 3,300 feet of 8" pipe to 18" diameter pipe along Ashworth Avenue N, from N 185th Street to N 175th Street.

The increased demand in TAZ 126 and 127, may require upsizing approximately 2,000 feet of pipe along NE 180th Street to 18" pipe, including upsizing the sewer connection under I-5.

Sections of sewer along NE Serpentine Place may need to be upsized to 18" diameter pipe if the region will be rezoned to R-48.

Under Alternative 4 – Preferred Alternative TAZs 34, 36, and 38 are hydraulically connected and are projected to generate a flow rate of 9.07 cfs. The improvements will be the same as Alternative 3, approximately 5,100 feet of 8" diameter sewer pipes will need to be upsized to 18" or greater diameter pipe network to handle the increase in flow, and additional 2,000 feet of 8" main would need to be upsized to 12" to 15" diameter pipe.

The zones draining to Lift Station #15 will generate a peak flow of approximately 9.9 cfs, or 4,447 gpm, which exceeds the pump's capacity. This may require upsizing Lift Station #15. Additionally to accommodate the forecasted flow, approximately 1,500 feet of 8" diameter pipe may need to be upsized to 18" or larger diameter pipe, and 650 feet of 8" diameter may need to be upsized to 12" to 15" diameter pipe. Similar to Alternative 3, upsizing Lift Station #15, may require upsizing of the force main and gravity lines downstream from the lift station, outside of the subarea. Hydraulic modeling will need to be completed for any proposed improvements based on the changed land use designations.

Lift Station #8 is located just north of the subarea, but is partially fed by lots within TAZ 37. Under Alternative 4, there is potential that 5.0 cfs or 2,270 gpm of peak flow would be generated from TAZ 37. Lift Station #8 has a pump capacity of 100 gpm with 39 feet of head. This may require upsizing Lift Station #8 and the surrounding force mains to accommodate forecasted flow.

Lift Station #14 may see an increase in peak flow up to 374 gpm, which exceeds the pump capacity. The lift station may need to be upsized to accommodate the projected flows forecasted from Alternative 4.

Twenty Year Improvements

The total length of wastewater improvements potentially necessary to accommodate the projected population in 2035 is approximately 10,100 feet of pipe improvements. The improvements include the following:

1. An analysis based solely on projected population growth and per capita demand projections, estimates the following pipe diameters may need to be upsized to 12" diameter pipes to accommodate the projected population in 2035. Under total build-out of Preferred Alternative #4, these pipe diameters may need to be upsized to 18" diameter pipes:
    a. 1,300 feet of pipe along N 185th Street, from Meridian Avenue N to 1st Avenue NE.
    b. 1,900 feet of pipe along 1st Avenue NE, from N 18^{8th} Street to N 18^{0th} Street.
    c. 2,000 feet of pipe along 3rd Avenue NE, from NE 185th Street to NE 180th Street, and NE 180th Street, from 3rd Avenue NE to 1st Avenue NE.
    d. 1,500 feet of pipe along 8th Avenue NE from 188th St to NE 185th Street and along NE 185th Street from 8th Avenue NE to Lift Station #15 on 12th Avenue NE

2. The following pipes may need to be upsized to 18" diameter pipes to accommodate the projected population in 2035. 18" diameter or larger pipes may be necessary under total build-out of Preferred Alternative #4:
    a. 2,700 feet of pipe along 5th Avenue NE

3. The following pipes may need to be upsized to 12" diameter pipes to accommodate the projected population in 2035. 12" diameter or larger pipes may be necessary under total build-out of Preferred Alternative #4:
    a. 650 feet of pipe along 8th Avenue NE, from NE 190th Street to NE 188th Street

4. Lift Station #15 may need to be upsized to accommodate estimated demand for the projected population in 2035. The 2035 population is projected to increase demand to this lift station to approximately 904 gpm. Under total build-out of Preferred Alternative #4, the projected demand flow would increase would be 4,450 gpm.

Alternative 3—Previous Most Growth

Alternative 3 is projected to increase demand throughout the subarea. Approximately 11,300 feet of 12" diameter pipe and 20,800 feet of 18" diameter pipe may need to be installed in new runs or upsized from existing 8" diameter mains to accommodate projected flows from the estimated population under Alternative 3.

The trunk main that collects wastewater from basin #23 is projected to collect as much as 11.70 cfs from the subarea under build-out conditions of Alternative 3. Similar to Alternative 4, the 24" trunk main was assumed to be of adequate size to handle this capacity under Alternative 3, though with additional flows from outside of the subarea, the pipe will need to be analyzed to verify it's flow capacity. The 1,660 feet of 18" diameter pipe along Corliss Avenue NE from NE 161st Street to NE 155th may need to be upsized to 24" or larger diameter pipe to accommodate the projected flows from the subarea and the surrounding community.

Similar to Alternative 2—Some Growth, TAZs 34, 36, and 38 under Alternative 3—Previous Most Growth are hydraulically connected to the same sewer drainage basin. Under Alternative 3, the peak sewer flow rate would be 9.69-cfs. Approximately 5,100 feet of 8" diameter sewer pipes may need to be upsized to 18" or greater diameter pipe network to handle the increase in flow, and additional 2,000 feet of 8" main may need to be upsized to 12" or 15" diameter pipe.

TAZs 124, 126, and half of zones 40, 65, and 125 would create an estimated peak flow of 8.1 cfs, or 3,626 gpm. This may require upsizing Lift Station #15. Additionally to accommodate the forecasted flow, approximately 5,200 feet of 8" diameter pipe may need to be upsized to 18" or larger diameter pipe, and 6,500 feet of 8" diameter may need to be upsized to 12" to 15" diameter pipe. Similar to Alternative 2, upsizing Lift Station #15, may require upsizing of the force main and gravity lines downstream from the lift station, outside of the subarea. Hydraulic modeling will need to be completed for any proposed improvements based on the changed land use designations.

Lift Station #8 is located just north of the subarea, but is partially fed by lots within TAZ 37. Under Alternative 3, there is potential that 1.2 cfs or 546 gpm of peak flow would be generated from TAZ 37. Lift Station #8 has a pump capacity of 100 gpm with 39 feet of head. This may require upsizing Lift Station #8 and the surrounding force mains to accommodate forecasted flow.

Lift Station #14 primarily serves residents outside of the subarea; however, due to its proximity to a proposed rezoning area, the lift station may be affected by rezoning that could occur under Alternative 3. The majority of TAZ 79 and a quarter of TAZ 127 discharges to Lift Station #14. Currently, Lift Station #14 has a pump rate of 240-gpm at 37 feet of head. The estimated combined demand entering the lift station would be approximately 170 gpm under peak conditions. Although the lift station appears to be sized correctly for forecasted demands, Lift Station #14 should be analyzed with the level of growth forecasted under Alternative 3.

Other potential improvements include upsizing approximately 2,000 feet of pipe along NE 180th Street to 12" pipe, including upsizing the sewer connection under I-5; upsizing, approximately 2,300 feet of pipe along 15th Avenue NE, south of 177th Avenue NE; and upsizing approximately 2,500 feet of existing pipe along 7th Avenue NE and 9th Avenue NE, from NE 180th St to NE 185th Street.

Alternative 2—Some Growth

TAZs 34, 36 and 38 are connected to the same sewer drainage basin. Based on demand analysis within the Ronald Wastewater District's Comprehensive Plan, a multiplier of four was applied to the average daily demand to convert to the peak amount

projected to enter the system at one time. The peak flow within this pipe network is projected to be 2.5675 cfs of wastewater. According to Table 28.3 of the Civil Engineering reference Manual, 12th Edition, an 8" diameter pipe flowing full at a minimum slope can handle 0.771 cfs. Approximately 7,800 feet of 8" diameter sewer pipes may need to be upsized to 12" to 15" diameter pipes to handle the increase in flow.

TAZs 124, 126, and half of zones 40, 65 and 125 enter into Lift Station #15 within the system. The estimated peak flow would be 735 gpm from these zones. The existing lift station has a max flow rate of 550-gpm. Although the entire projected demand may not discharge into this lift station, Lift Station #15 may be undersized if Alternative 2 is implemented. Additionally, the lift station's overflow line terminates at the proposed site of the Link Light Rail Station. Modifications may be necessary to the lift station location and size under Alternative 2, 3, or 4. Additionally, 2,800 feet of 8" diameter pipe may need to be upsized to 12" diameter pipe to assist with the sewer flow from the lift station. Upsizing Lift Station #15 may require upsizing of the force main and gravity lines downstream from the lift station, outside of the subarea. Hydraulic modeling will need to be completed for any proposed improvements based on the changed land use designations.

Other potential improvements include upsizing approximately 2,300 feet of pipe along 15th Avenue NE, south of 177h Avenue NE, and 700 feet of pipe along 8th Avenue NE, from NE 180th St to NE Serpentine Place.

Alternative 1—No Action

Potential demand generation from the Alternative 1—No Action would create a 15 percent increase in wastewater generation. No pipe upsizing other than what is proposed within the Comprehensive Plan should be necessary to accommodate future growth. No costs are associated with the adoption of Alternative 1.

Surface Water

Table 3.5-18 contains a list of surface water facilities projected to manage future runoff and increased impervious surface associated with development from each alternative.

Table 3.5-18
Surface Water System Upgrades

Alternative	12" Pipe[1]	18" Pipe[2]	24" Pipe[3]	Pump Station Upsizing
#1 — No Action	0	0	0	0
#2 — Some Growth	15,300	8,800	0	MC03
#3 — Previous Most Growth	22,100	17,300	0	MC03 & Serpentine Pump Station
#4 —Preferred Alternative	11,300	35,700	4,300	MC03 & Serpentine Pump Station
2035 Improvements	4,300	20,400	2,600	MC03

Alternative 4—Preferred Alternative

Many of the existing streets currently contain ditches and swales at the edges of the roadway. When new developments are constructed within the subarea, streets would be improved to

accommodate the added influx of users. When this occurs, some of the open ditches may be converted to a closed pipe network. There is also the possibility that low impact development (LID) treatments such as bioswales, stormwater planters, rain gardens and/or other features may reduce the need for pipe replacement and upsizing,

Approximately 51,300 feet of new or upsized pipe may be needed to handle projected surface water runoff from future development. Similar to Alternative 3, the two pump stations may receive additional flow from the surrounding developments.

Under Alternative 2, 3, or 4, there could be an opportunity to study and implement a regional stormwater facility project that would serve future growth. This project could include construction of a regional system of facilities funded through grants and capital improvement planning. Providing regional facilities can help to catalyze redevelopment by reducing costs of stormwater infrastructure improvements to individual site development, similar to several other examples in the region, including the Overlake Village Light Rail Station area in Redmond. Individual developments would be required to provide water quality treatment, but detention and flow control could be handled by the regional facilities.

Additionally, implementation of LID and green stormwater infrastructure solutions as part of public right-of-way improvements as well as onsite development would have a beneficial effect in reducing impacts in the subarea by enhancing stormwater treatment and management.

Twenty Year Improvements

The total length of surface water pipe improvements potentially necessary to accommodate the projected population in 2035 is approximately 27,300 feet of pipe. The improvements include the following:

1. An analysis based solely on projected population growth and per capita demand projections, estimates the following pipe diameters may need to be upsized to 18" diameter pipes to accommodate the projected population in 2035. Under total build-out of Preferred Alternative #4, these pipe diameters may need to be upsized to 24" diameter pipes:
    a. 570 feet along N 185th Street, from Stone Avenue to Ashworth Avenue
    b. 1,080 feet along N 185th Street, from Densmore Avenue to Burke Avenue
    c. 970 feet along Wallingford Avenue, from N 185th Street to N 188th Street

2. The following pipes may need to be upsized to 18" diameter pipes to accommodate the projected population in 2035. 18" diameter or larger pipes may be necessary under total build-out of Preferred Alternative #4:
    a. 450 feet along N 185th Street, from Densmore Avenue to Wallingford Avenue
    b. 600 feet along Densmore Avenue, from N 185th Street to N 188th Street
    c. 930 feet along Burke Avenue, from N 185th Street to N 188th Street
    d. 500 feet along N 185th Street, from Meridian Avenue to Corliss Avenue

e. 240 feet along Corliss Avenue, from N 184th Street to N 185th Street
f. 920 feet along Bagley Place N, from N 187th Street to N 185th Street
g. 620 feet along N 180th Street, from 1st Avenue NE to Cromwell Park
h. 1,530 feet along 3rd Avenue NE, from the north end to NE 180th Street, continue along NE 180th Street to 1st Avenue NE
i. 820 feet along 2nd Avenue NE, from the north end to NE 180th Street
j. 890 feet along N 185th Street, from Sunnyside Avenue to 3rd Avenue NE
k. 350 feet along 2nd Avenue NE, from the south end to N 185th Street
l. 350 feet along 3rd Avenue NE, from the south end to N 185th Street
m. 3,900 feet along 5th Avenue NE, from N 185th Street to NE 195th Street
n. 570 feet along N 185th Street, from 3rd Avenue NE to 5th Avenue NE
o. 680 feet along NE 190th Street, from 8th Avenue NE to 10th Avenue NE
p. 1,320 feet along 10th Avenue NE, from NE 190th Street to NE 185th Street
q. 650 feet along NE 185th Street, from 10th Avenue NE to 8th Avenue NE, and south along 8th Avenue NE to NE 183rd Street
r. 250 feet along 9th Avenue NE, from the south end to NE 185th Street
s. 250 feet along 10th Avenue NE, from the south end to NE 185th Street
t. 1,480 feet along NE 180th Street, from 15th Avenue NE to 10th Avenue NE
u. 270 feet along 14th Avenue NE, from the north end to NE 180th Street

3. The following new 12" diameter pipe runs may need to be installed to accommodate the projected population in 2035. 12" diameter or larger pipes may be necessary under total build-out of Preferred Alternative #4:
   a. 400 feet along N 184th Street, from the east end to Corliss Avenue
   b. 1,310 feet along 8th Avenue NE, from NE 190th Street to NE 188th Street, and east along NE 188th street to 10th Avenue NE
   c. 670 feet along NE 189th Street, from 8th Avenue NE to 10th Avenue NE
   d. 310 feet along NE 182nd Street, from 10th Avenue NE to 11th Avenue NE
   e. 1,200 feet along 7th Avenue NE, from the north end to NE 180th Street
   f. 370 feet along 5th Avenue NE, from NE 185th Street to the connection with the existing pipe

4. The following new 12" diameter pipe runs may need to be installed to accommodate the projected population in 2035. 18" diameter or larger pipes may be necessary under total build-out of Preferred Alternative #4:
   a. 720 feet along 8th Avenue NE, from the south end to NE 185th Street
   b. 800 feet along 9th Avenue NE, from the south end to NE 185th Street

c. 800 feet along 10th Avenue NE, from the south end to NE 185th Street
d. 550 feet along 6th Avenue NE, from the north end to NE 180th Street

5. Pump Station MC03 likely would need to be upsized to accommodate estimated demand for the projected population in 2035. (Note: MC03 is also called Pump Plant 26 by some data sources. It is located on the south side of NE 185th Street, between 9th Avenue NE and 10th Avenue NE.)

Alternative 3—Previous Most Growth

Approximately 39,400 feet of new or upsized pipe may be needed to handle projected surface water runoff from future development. Two pump stations may receive additional flow from the surrounding developments, Pump Station MC03 and the Serpentine Pump Station. Since the Serpentine Pump Station is already projected to be improved due to flooding issues, the design may need to be reanalyzed for future flows.

Alternative 2—Some Growth

TAZ 38 currently contains a large infiltration field. If this zone is projected to be redeveloped as projected in either Alternative 2—Some Growth, Alternative 3—Previous Most Growth, or Alternative 4—Preferred Alternative, there may not be room for the infiltration field. An alternative flow control facility and upsizing connecting surface water pipes from the existing 12" diameter pipes may be required.

Under Alternative 2—Some Growth, approximately 15,000 feet of 12" or larger pipe may need to be installed. Improvements would not be limited to pipe installation, but would need to include catch basins, and detention/treatment facilities. Pump Station MC03 may need to be upsized in order to receive additional flows from TAZ 126.

In total, approximately 24,100 feet of new or upsized pipe may be needed to accommodate future growth within the subarea, to handle added surface water runoff from future development.

Alternative 1—No Action

Since Alternative 1—No Action would contain the same zoning as under existing conditions, no additional surface water runoff is projected within the subarea, and no additional improvements except those described in Section 3.5.3.a would be necessary. However, it should be noted that creation of new households or infill redevelopment could occur under Alternative 1—No Action. New sites and households would be required to manage stormwater related to individual redevelopment, even though there would be no capital improvements at a larger scale.

Electricity

Although no data was made available for Seattle City Light's existing distribution network, primary improvement to the system would be undergrounding existing overhead lines when new developments are constructed within the subarea, as feasible.

Alternative 4—Preferred Alternative Build-Out

The majority of the subarea would see a substantial increase in energy use under Alternative 4 at build-out, but this would occur

gradually over many decades. TAZs 40, 124, 126, and 127 would not need much upsizing of the distribution lines due to their proximity to the Seattle City Light transmission corridor. No issues are anticipated in acquiring the additional energy supply to serve these zones. Zones west of I-5 are located further from the Seattle City Light transmission corridor and may require upsized distribution lines and transformers to adequately serve these areas.

Alternative 3—Previous Most Growth

The primary energy demand increase would occur in TAZs 7, 10, 11, 38, 124, and 126. Similar to Alternative 2, TAZs 124 and 126 would not need much upsizing of the distribution lines due to their proximity to the Seattle City Light transmission corridor. It should be relatively easy to acquire additional energy supply to these zones. Zones 7, 10, 11, and 38, may require additional distribution lines and transformers to adequately serve these areas.

Alternative 2—Some Growth

The primary energy demand increase would occur in TAZs 7, 10, 38, 124, and 126. The Seattle City Light transmission corridor runs through TAZs 124 and 126. It should be relatively easy to acquire additional energy supply to these TAZs. TAZs 7, 10, and 38, may require additional distribution lines and transformers to adequately serve these areas.

Alternative 1—No Action

The primary energy demand increase would occur in TAZ 7. Additional distribution lines and transformers may need to be installed to adequately service this area.

Natural Gas

No data was provided to support analysis of demand for Puget Sound Energy natural gas. Puget Sound Energy is a privately owned company. All improvements are based on future customer requests, and funding for future growth would be financed by customer fees within the region. Because natural gas is readily available to the area, it is not anticipated that there would be any issues in extending service to serve future growth.

Energy Efficiency Considerations

Related to energy use, including electricity and natural gas, technological advancements in building systems and design are improving efficiency on an ongoing basis. New developments are more commonly integrating green building and alternative energy systems (solar, geothermal, etc.), as well as more energy efficient design and fixtures. These approaches will maximize energy conservation and help the region and city achieve Climate Action Plan goals, in addition to reducing impacts on energy providers. The City intends to explore the potential implementation of district energy and encourage combined heat and power systems with redevelopment as called for in the Subarea Plan policies. The City also intends to pursue a solarization program, community solar, or other innovative ways to partner with local businesses and organizations to promote installation of photovoltaic systems.

Communications

No data was provided for any of the communication companies' distribution networks. The primary improvement to the system would be undergrounding existing overhead lines when new developments are constructed within the subarea. All communication networks are privately owned entities. Funding to

serve future growth would be financed by customer fees within the region. As such, there would not be adverse impacts associated with providing communication services in the future under any of the alternatives.

Considerations Related to Redevelopment in Both Station Subareas

The 145th Street EIS Report and 185th Street EIS Report were analyzed as standalone rezoning alternatives. Depending on which alternative is selected for each subarea, the resultant zoning would have a combined effect on the supporting infrastructure.

Water—North City Water District

The primary concern with the combined effect of both subareas on the existing system is the North City Water District's current approved rate of withdrawal from Seattle Public Utility's Tolt River Transmission Main. The current approved maximum withdrawal rate from the transmission main is 3,300 gallons per minute. **Table 3.5-19** provides a comparison of the two study areas to the maximum withdrawal rate.

This analysis does not include demand from the rest of the North City Water District, which relies on this withdrawal rate as well. Based only on the two subareas, if the highest population density zoning alternatives are selected for both subareas, the North City Water District will have a deficit in their water withdrawal rate. Prior to build-out of the selected alternative, the North City Water District will need to coordinate with Seattle Public Utilities to acquire additional water withdrawal from the Tolt River Transmission Main.

Table 3.5-19—North City Water District Source of Supply Analysis for Both Alternatives

North City Water District Maximum Withdrawal Rate (GPM)				
3,300				
145th Street Subarea				
Existing Conditions (GPM)	Alt 1 (GPM)	Alt 2 (GPM)	Alt 3 (GPM)	
251	374	1,338	1,507	
185th Street Subarea				
Existing Conditions (GPM)	Alt 1 (GPM)	Alt 2 (GPM)	Alt 3 (GPM)	Alt 4 (GPM)
249	274	536	1,228	1,846

Currently, both the 145th Street Subarea and 185th Street Subarea are within the 590 Pressure Zone, and fed by the same supply stations, booster pumps, and storage reservoir. If the highest population density zoning alternatives are selected for both subareas, all connecting appurtenances will need to be analyzed in conjunction with the demand generated from the surrounding community. If the new pressure zone, 515 is constructed around the 145th Street Subarea, the two subareas will no longer be connected, and the only resource used by both communities would be the 3.7-million gallon storage reservoir located near the intersection of 15th Avenue NE and NE 177th Street.

This reservoir currently serves the 615 and 590 pressure zones, and would serve as backup storage for the proposed 515 Pressure Zone. The reservoir would still need to supply standby storage of two times the average daily demand for all three pressure zones. **Table 3.5-20** contains a comparison of maximum available storage within

the reservoir to two times the average daily demand for both subareas under each scenario. Based on this information, the storage reservoir may be undersized for full build-out of the highest population density zoning alternative selected for both subareas.

Table 3.5-20
North City Water District - Standby Storage Analysis

North City Water District Available Effective Storage (Millions of Gallons)[1]				3.7
145th Street Subarea - Average Daily Demand x 2				
Existing Conditions - 2 x ADD (MGPD)[2]	Alt 1 - 2 x ADD (MGPD)	Alt 2 - 2 x ADD (MGPD)	Alt 3 - 2 x ADD (MGPD)	
0.72	1.08	3.85	4.34	
185th Street Subarea - Average Daily Demand x 2				
Existing Conditions - 2 x ADD (MGPD)	Alt 1 - 2 x ADD (MGPD)	Alt 2 - 2 x ADD (MGPD)	Alt 3 - 2 x ADD (MGPD)	Alt 4 - 2 x ADD (MGPD)
0.72	0.79	1.54	3.54	5.32

1.) Effective Storage was taken as the entire volume of the 3.7 million gallon Reservoir, assuming nested standby and fire suppression storage, and not factoring in equalizing storage for the purposes of this report.
2.) Million Gallons Per Day (MGPD)

Water—Seattle Public Utilities

Similar to the North City Water District, the Seattle Public Utilities portion of both subareas are within its own 590 Pressure Zone, and fed by the same supply stations, booster pumps, and storage reservoir. Due to the extensive nature of the Seattle Public Utilities water system, a proper analysis could not be performed between the two subareas and connecting appurtenances. Once the desired alternatives have been selected, the hydraulic model should be updated to properly evaluate all supply stations, booster pumps, and reservoirs connected to the system. **Table 3.5-21** provides a side by side analysis of the two study areas water demand rates.

Table 3.5-21—Seattle Public Utilities
Combined Subarea Water Demand Analysis

145th Street Subarea					
	Existing Conditions	Alt 1	Alt 2	Alt 3	
Withdrawal Rate (GPM)	228	269	958	783	
Recommended Storage (MGPD)	0.66	0.78	2.76	2.26	
185th Street Subarea					
	Existing Conditions	Alt 1	Alt 2	Alt 3	Alt 4
Withdrawal Rate (GPM)	216	244	813	1,644	1,710
Recommended Storage (MGPD)	0.62	0.70	2.34	4.74	4.92

Wastewater

The primary concern with the combined effect of both subareas on the existing system is an analysis of the prime trunk main collecting wastewater from both subareas. The majority of both subareas

collect wastewater within basin #23. The main trunk main begins in the 185th Street subarea, as a 24" diameter pipe, collecting wastewater from as far north as NE 190th Street, as far west as Ashworth Avenue N, and as far east as 15th Avenue N. This trunk main continues along Meridian Avenue N, Corliss Avenue N, and along the I-5 Corridor, collecting wastewater from a large portion of the City of Shoreline as it heads south. The trunk main turns into a 30" main at the intersection of NE 155th Street and I-5, as it enters the 145th Street Subarea. **Table 3.5-22** provides a comparison of the estimated peak flow (four times the average daily demand) for the two subareas entering this trunk main.

Table 3.5-22—Ronald Wastewater, Basin #23 Combined Subarea Peak Wastewater Estimated Flow Analysis

145th Street Subarea				
Existing Conditions (CFS)	Alt 1 (CFS)	Alt 2 (CFS)	Alt 3 (CFS)	
3.04	3.96	14.36	13.38	
185th Street Subarea				
Existing Conditions (CFS)	Alt 1 (CFS)	Alt 2 (CFS)	Alt 3 (CFS)	Alt 4 (CFS)
2.24	2.50	3.93	11.70	13.58

This analysis does not include demand from the rest of Basin #23, which drains into this trunk main. Based only on the two subareas, if the highest population density zoning alternatives are selected for both subareas, the Ronald Wastewater District may need to upsize a large portion of this pipe. Additionally, this pipe enters the Seattle Public Utilities District once it crosses NE 145th Street. SPU will need to evaluate the capacity of this pipe once it enters their system, based on the projected demand from the selected alternatives.

3.5.4 Significant Unavoidable Adverse Impacts

Increased demand for utilities services and facilities within the subarea would occur under all four alternatives, with Alternative 4 generating the most demand at build-out, followed by Alternative 3, Alternative 2, and then Alternative 1. Existing deficiencies within the water, wastewater, surface water, electricity, and communications service areas would need to be addressed over time as the subarea grows in population, households, and businesses.

Growth and change would be expected to occur gradually over many decades under any of the four action alternatives. Implementation of full build-out of Alternative 4—Preferred Alternative would take 80 to 125 years. Alternative 3—Previous Most Growth would take 60 to 100 years to reach full build-out, and Alternative 2—Some Growth would take an estimated 30 to 50 years. As such, utility service providers would be able to monitor growth and adapt management, services, and facilities to serve increases in demand over time, assuming that funding keeps pace with growth. Given these long timeframes, it is also likely that technological innovations, behavioral changes, and more stringent building and energy codes may also mitigate impacts related to utilities. Energy efficiency may be achieved through combined heat and power systems, possible district energy, the potential use of solar power and/or geothermal, and other applications. With application of the capital improvement projects discussed, along with regulatory requirements, no significant unavoidable adverse impacts would be anticipated.

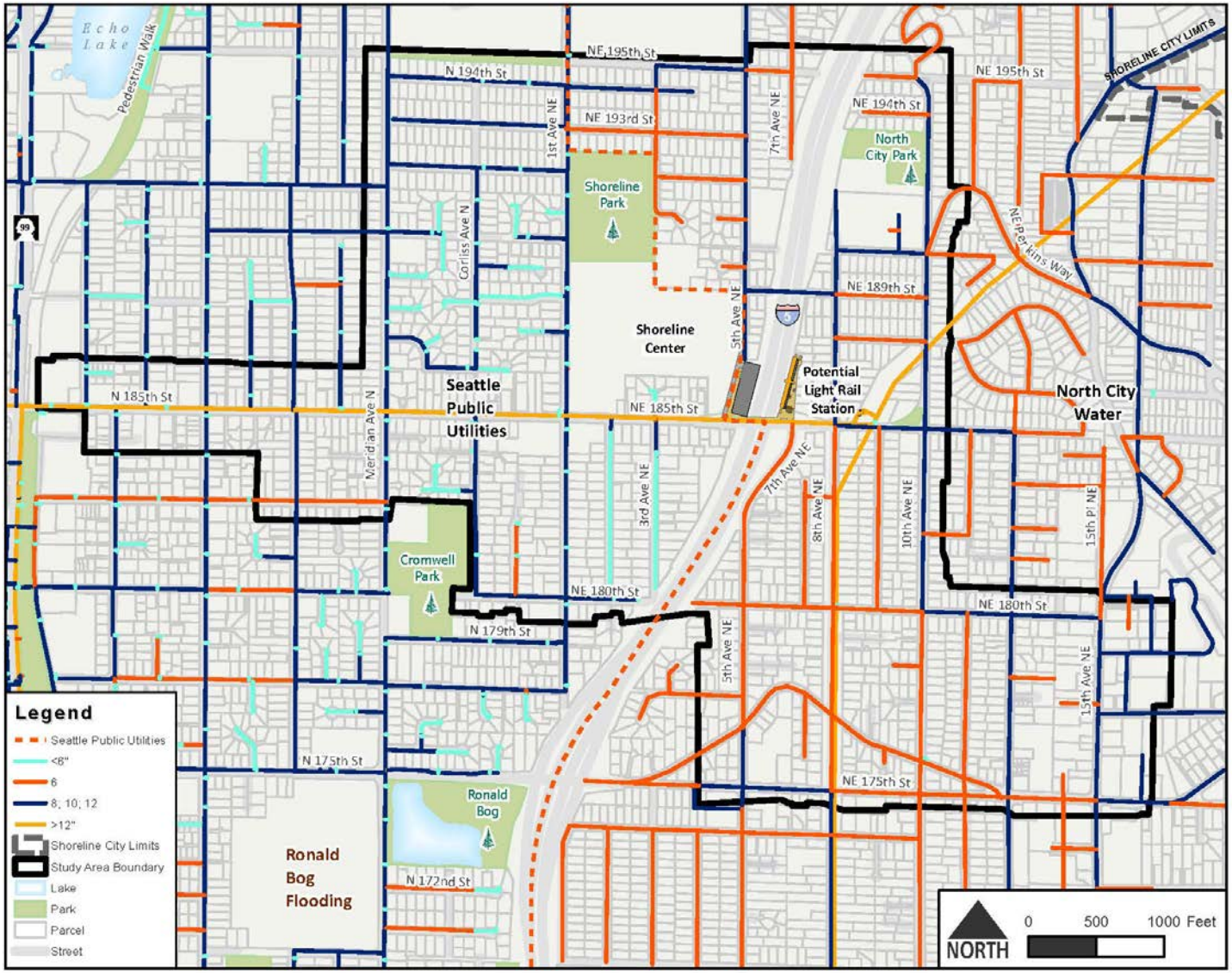

Figure 3.5-1 Existing Water Facilities in the Subarea

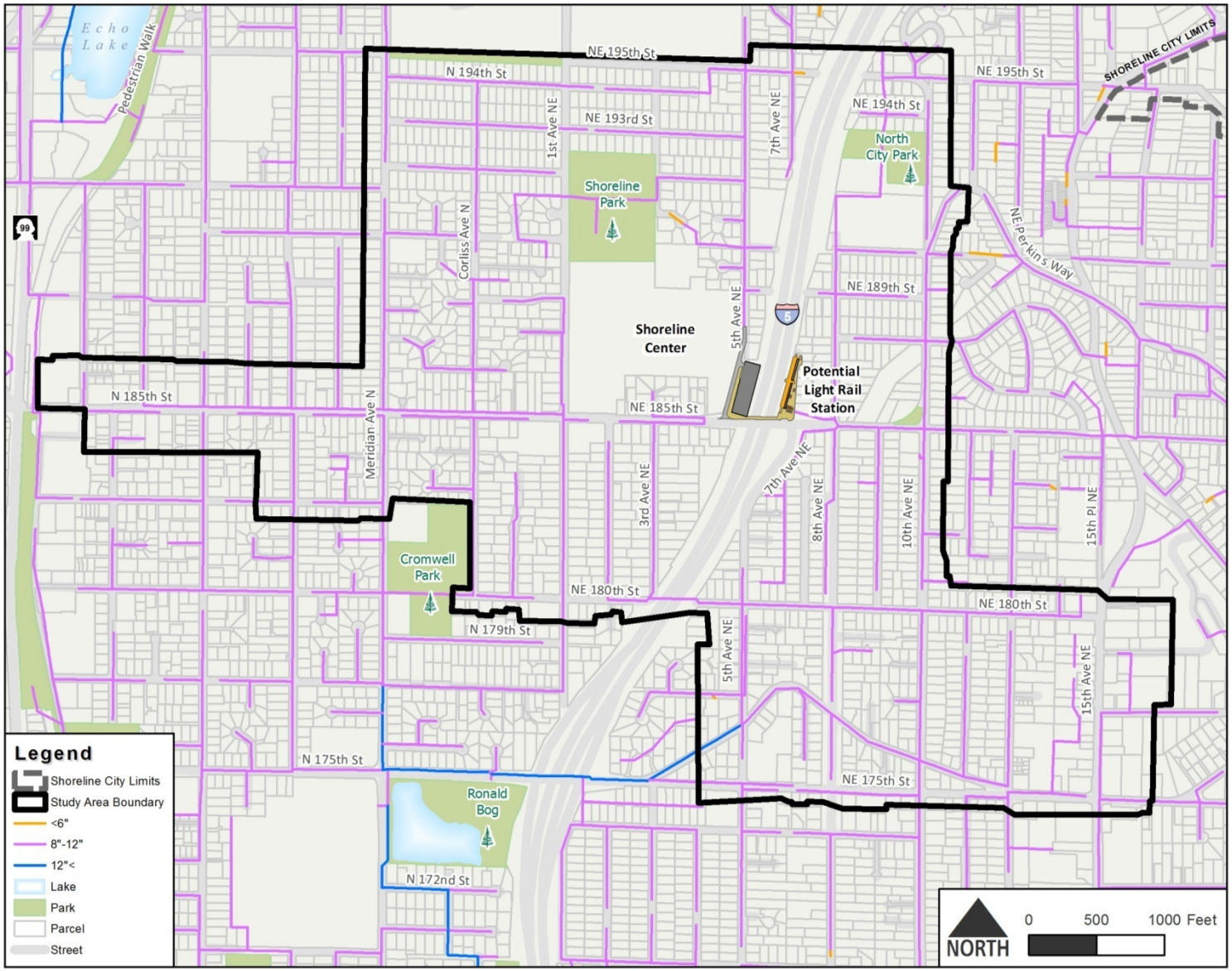

Figure 3.5-2 Existing Wastewater Facilities in the Subarea

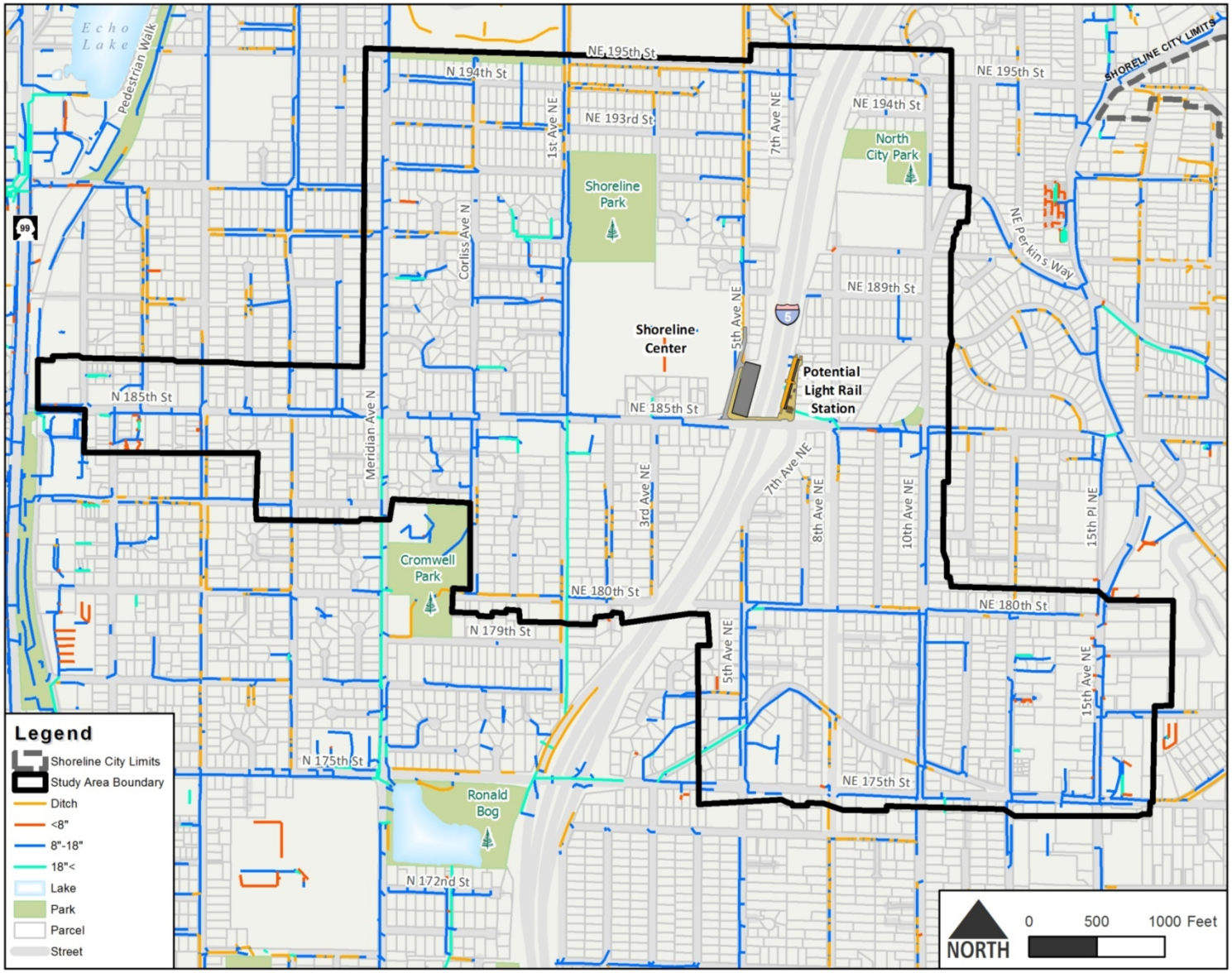

Figure 3.5-3 Existing Surface Water/Stormwater Facilities in the Subarea

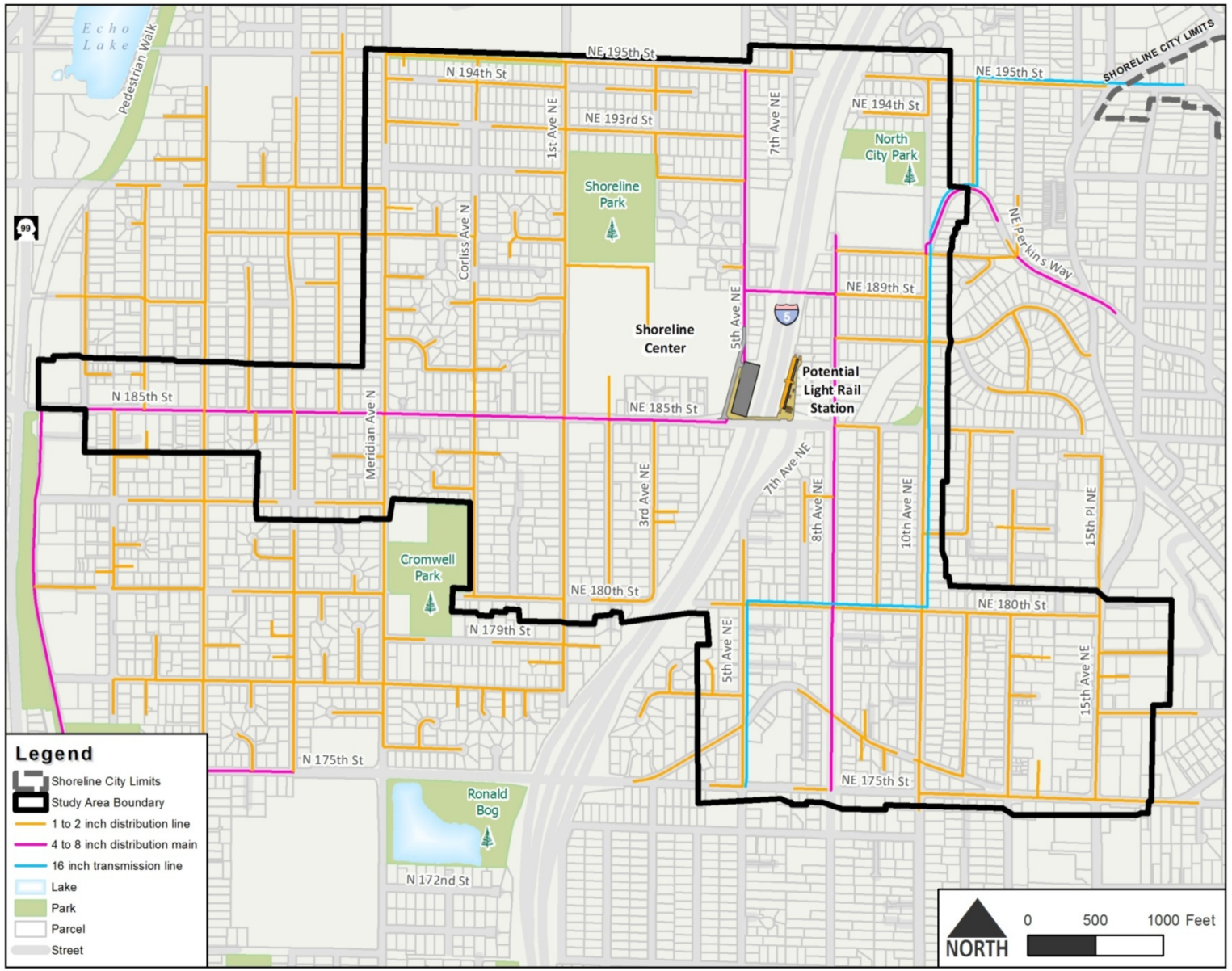

Figure 3.5-4 Existing Natural Gas Lines in the Subarea

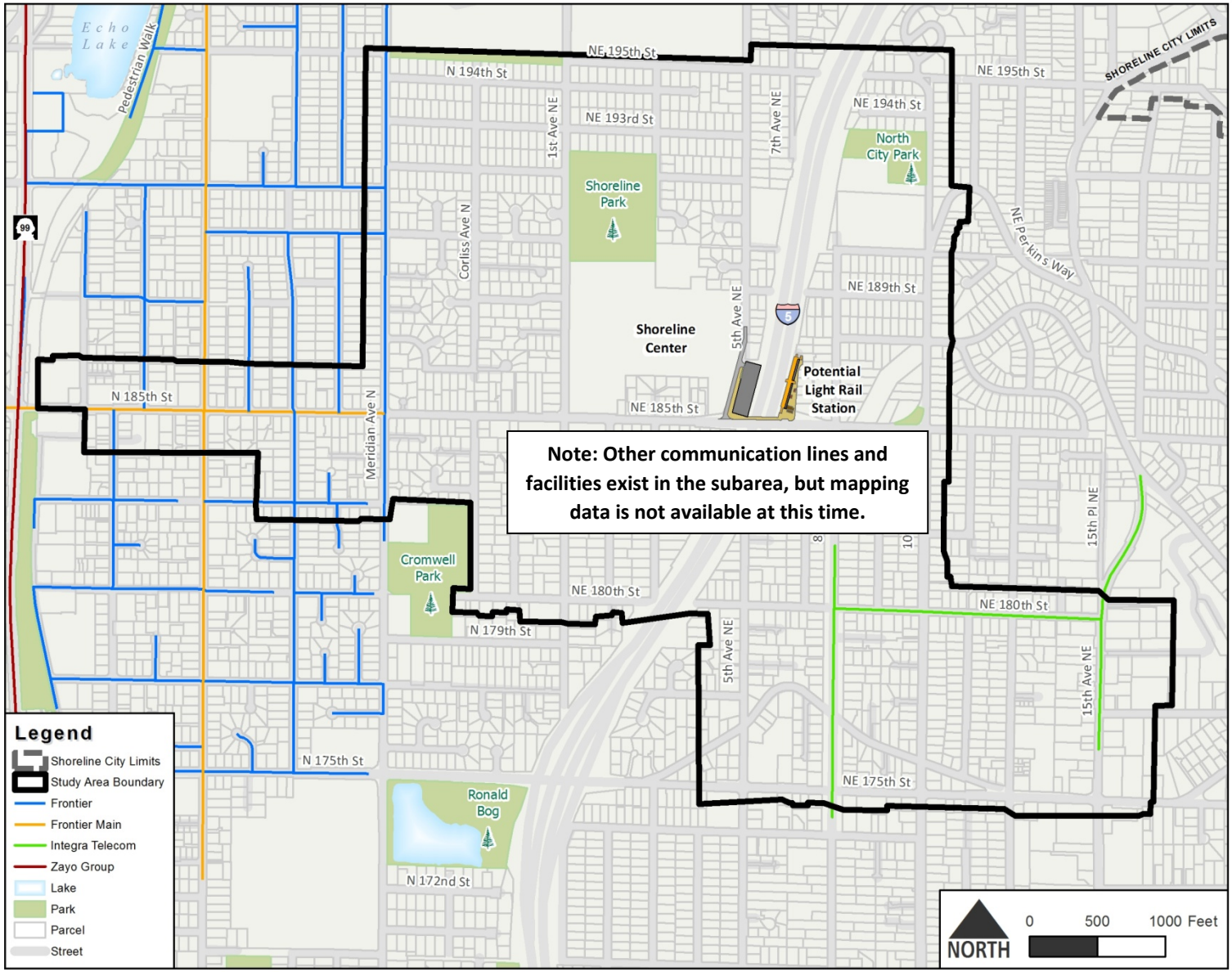

Figure 3.5-5 Communications Facilities (Partial) in the Subarea

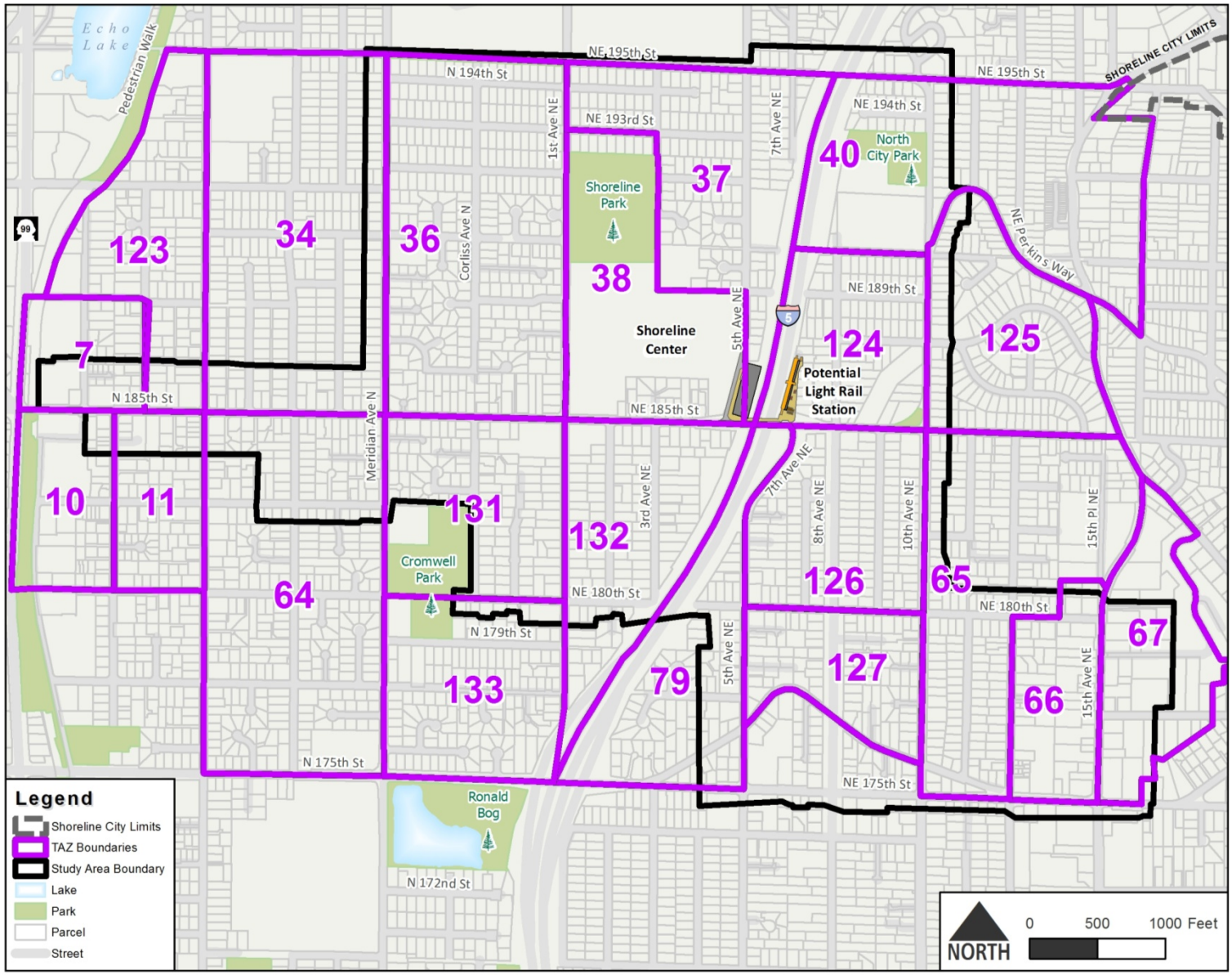

Figure 3.5-6 Traffic Analysis Zones (TAZs) in Proximity to the Subarea

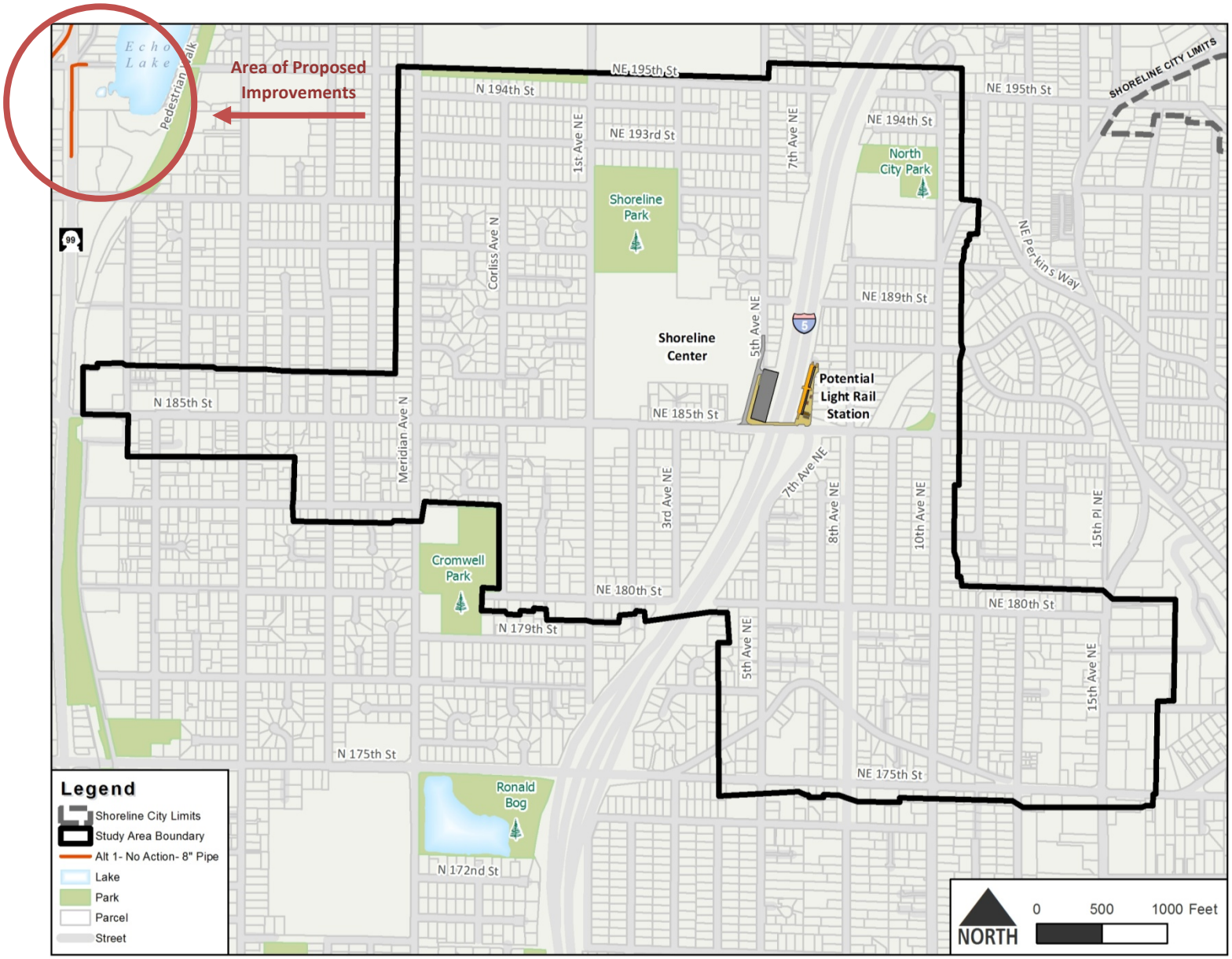

Figure 3.5-7 Planned Water Improvements in the Vicinity of the Subarea

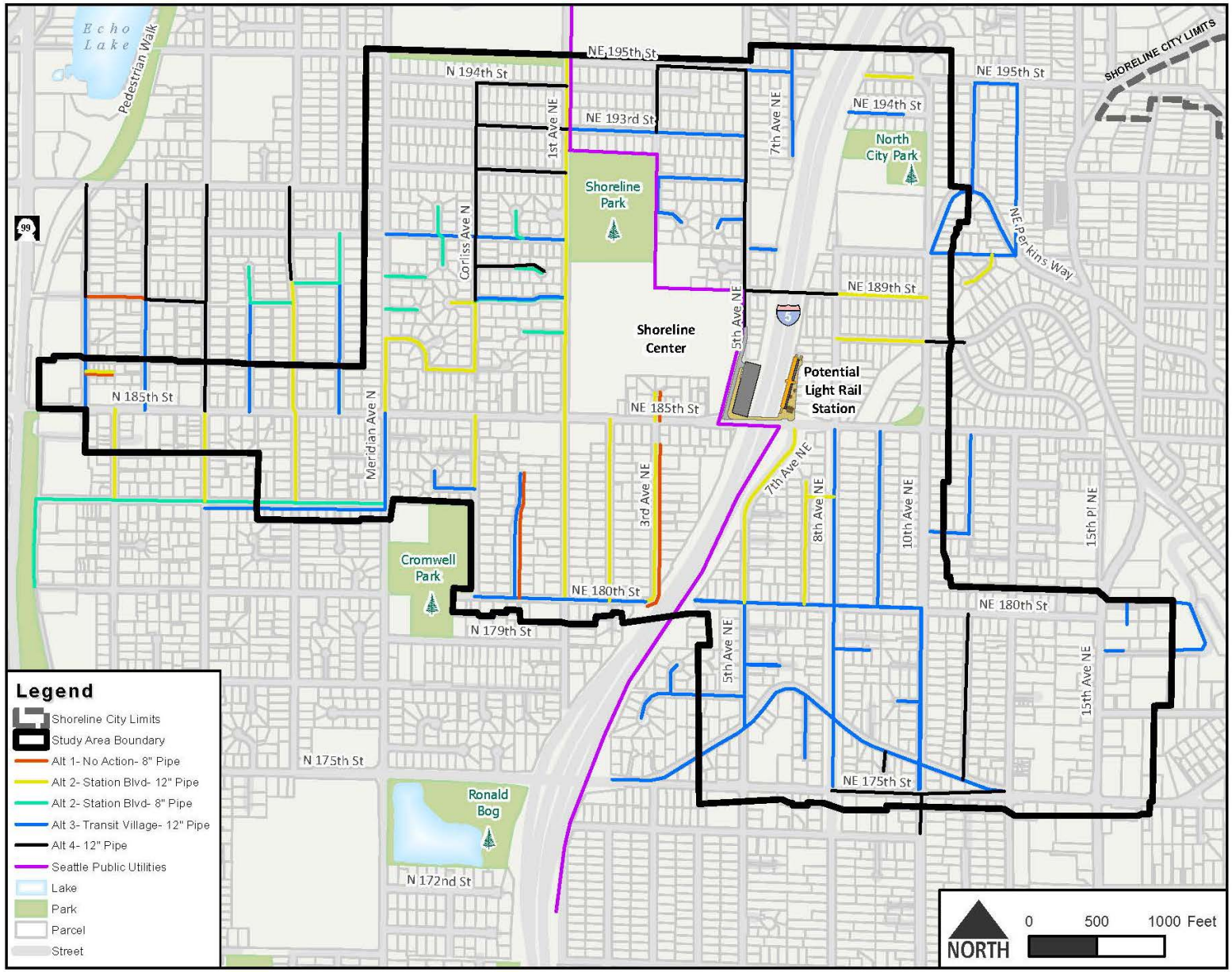

Figure 3.5-8 Other Recommended Future Water Improvements for Mitigation of the Action Alternatives

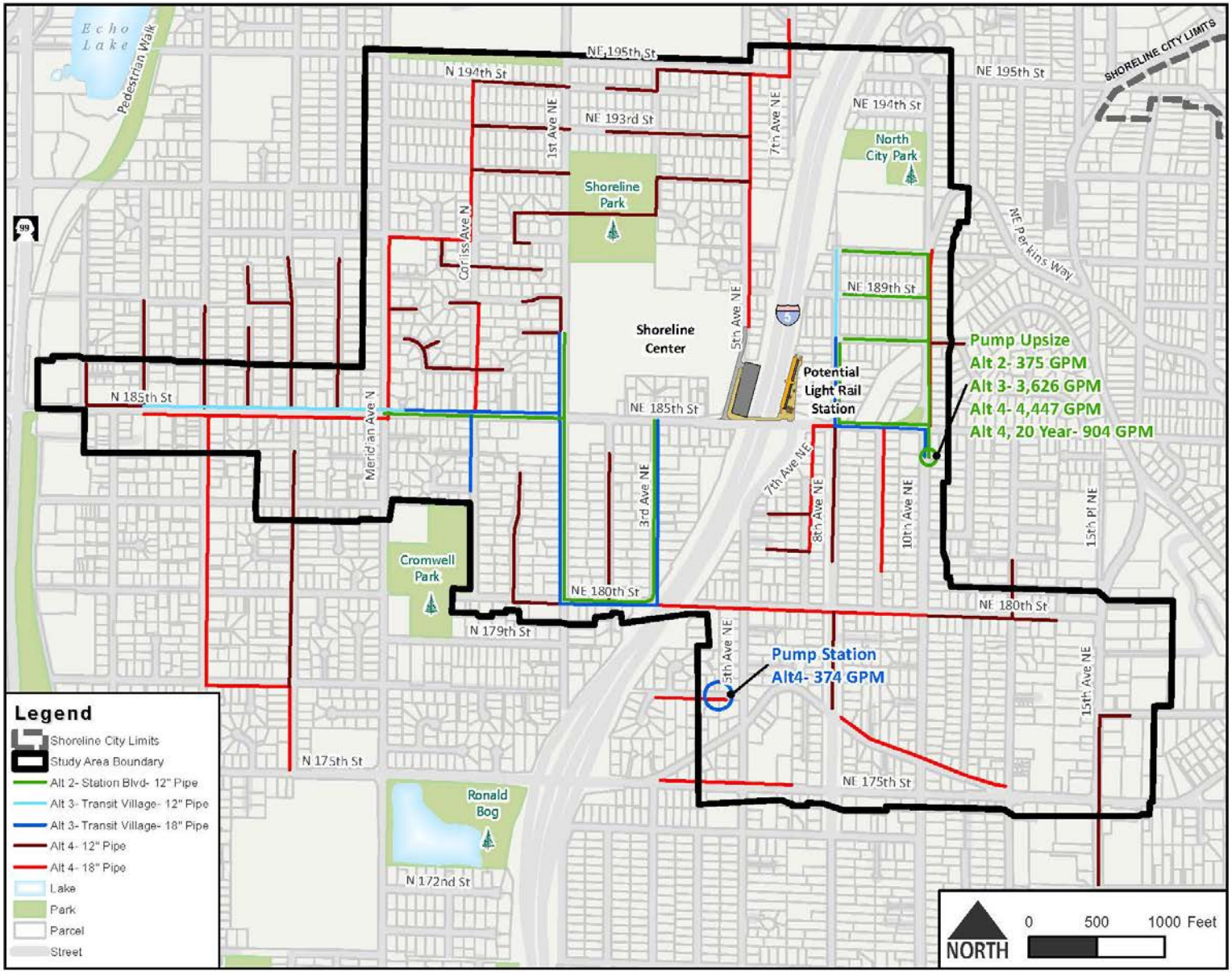

Figure 3.5-9 Recommended Future Wastewater Improvements for Mitigation of the Action Alternatives

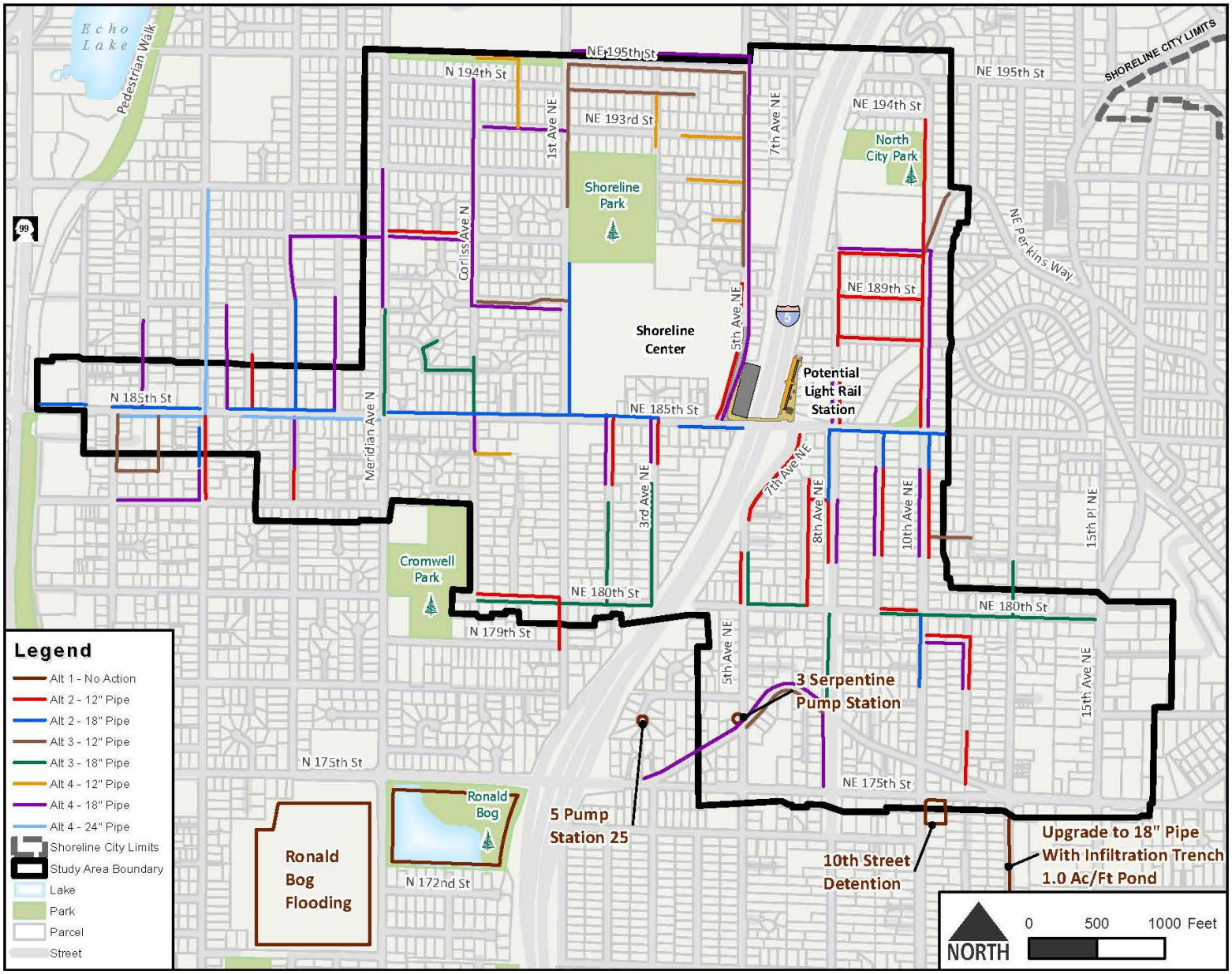

Figure 3.5-10 Planned and Recommended Surface Water/Stormwater Drainage Improvements in the Vicinity of the Subarea